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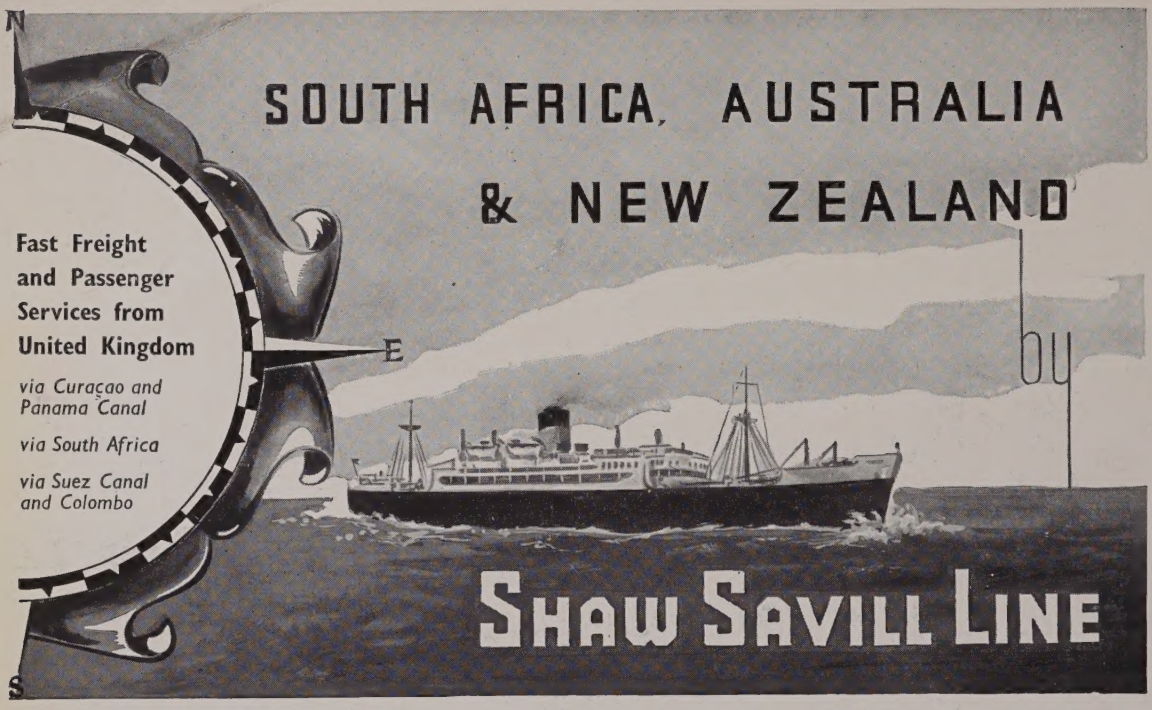
GEOGRAPHICAL MAGAZINE



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The Scottish Iceland Expedition, 1952

by JOHN PIRRIT

THERE are those who say that expeditions must have at least one year's planning and that everything should be cut and dried long before the sailing date. If this were the case the Scottish Iceland Expedition, 1952, would never have left Glasgow. We were a group of seven students, mostly undergraduates, and there was very little time to spare for detailed plans before sailing.

At the most we had four months' spasmodic organizing. The innumerable letters to shipping agents, food firms, tent makers, and Iceland authorities had to be written between lectures and examinations. Vital maps and aerial photographs arrived only two days before we left, but we had, in common, enthusiasm for our venture and a belief that in spite of split-second timing everything would work out all right.

Our plans were deliberately flexible. Our programme included botanical and geological work, the final details of which could not be settled until we were on the spot. However, we did know that considerable travelling would be involved, and for the sake of mobility we cut equipment to a minimum. Light one-man and two-man tents were used, and dehydrated concentrated foods were taken from Scotland, enabling us to live for weeks at a time in the mountains, where most of our work was done.

In the party were three geologists, R. Dearnley, an Honours student from Leeds, F. Matheson and myself from Glasgow. The surveying was undertaken by a geography student, F. Parlane, from Glasgow, and R. Newton from Nottingham. M. Murray, an ex-Fleet Air Arm photographer, from Edinburgh, took most of the photographs, and the very able botanist of the party was D. McVean, who graduated from Glasgow three years ago and had just finished a research course at Cambridge.

Iceland was chosen because of its immense interest to both geologist and botanist. Most of its 140,000 inhabitants live in Reykjavík, while the others are scattered widely in the small fishing villages which are found around the coasts, usually at the heads of fjords. The interior is an uninhabited lava desert with permanent ice-caps on the highest ground. The roads are very bad, unsurfaced, and used only in the summer months. Communication is mostly by means of small coastal steamers.

We planned to spend a large proportion of our time in the mountainous eastern part of the island. There was much virgin country here from the scientific point of view and there were some special problems to be tackled. The most important of these concerned botanist and geologists alike: the search for fossil plants. These plants are the only means of accurately dating the rocks. None had been found before in the east, though for many years collections had been made and studied from the north-west peninsula. From these collections it was established that the rocks of West Iceland were of Miocene age, that is, about 20,000,000 years old.

The interesting thing about the plant remains is that they show that the climate in Iceland has not always been so cold as it is today. It was at that time comparable with the Mediterranean climate now. The rocks in the east are separated from those in the west by a series of faults, and we were very anxious to find some fossil plants in the eastern part of the country so as to compare the ages of the two areas.

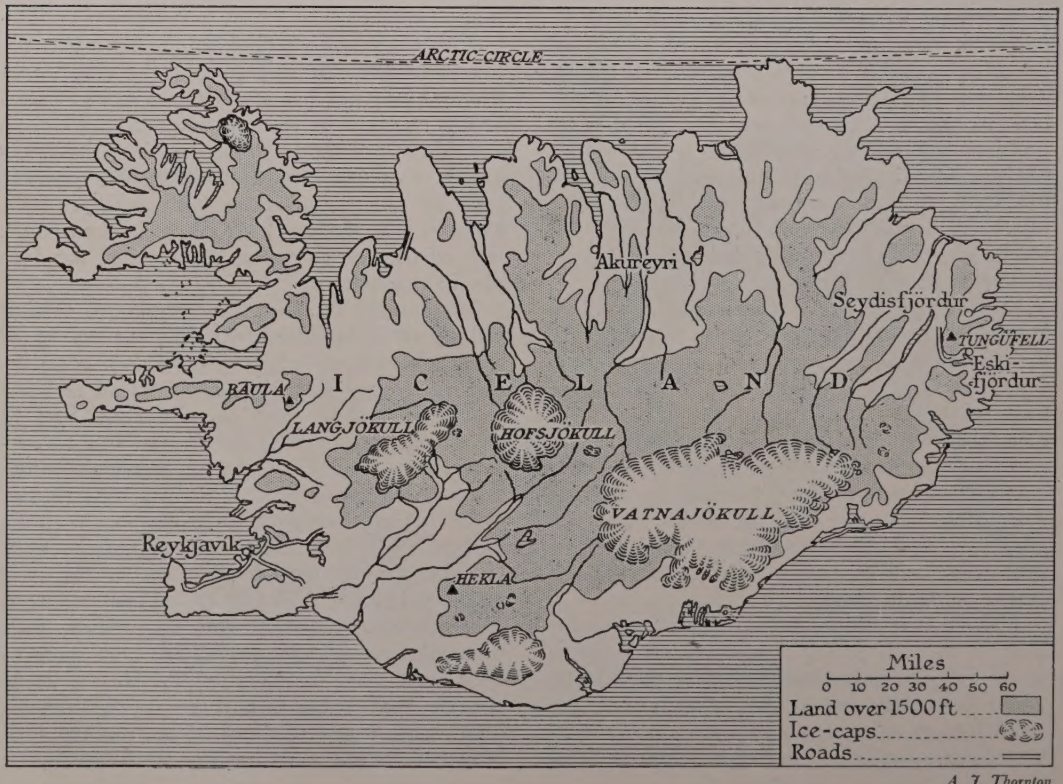
We landed at the tiny east-coast fishing village of Eskifjördur on July 14 ready to start operations. We wasted no time in setting up our first base-camp in an isolated mountain corrie, just on the snow-line at 3000 feet, overlooking the fjord. The mountains were entirely made up of basaltic lava flows piled horizontally one on top of the other. They weathered readily into sharp ridges and pinnacles which were very treacherous for climbing and, under the crags, vast scree slopes hindered our progress. Occasionally, between the lava flows, thin intercalations of lignite and ash beds were to be found, and in these there was a faint chance that there might be a fossiliferous layer with plant remains. We split up into ones and twos and searched systematically for

the fossils but without success. Iceland is today practically treeless and although we found no fossil plants, we occasionally found fossilized tree-trunks and the charred remains of branches. These obviously were the remnants of some ancient forest which had established itself during a period of rest from the volcanic activity which had built the foundation of Iceland more than 20,000,000 years ago. With the resumption of vulcanism, fresh lavas had poured out over the landscape charring the vegetation beyond recognition. Under such conditions it can be realized that preservation of leaves or identifiable parts is unlikely and after two weeks of continual searching not a scrap of leaf of any kind had been found.

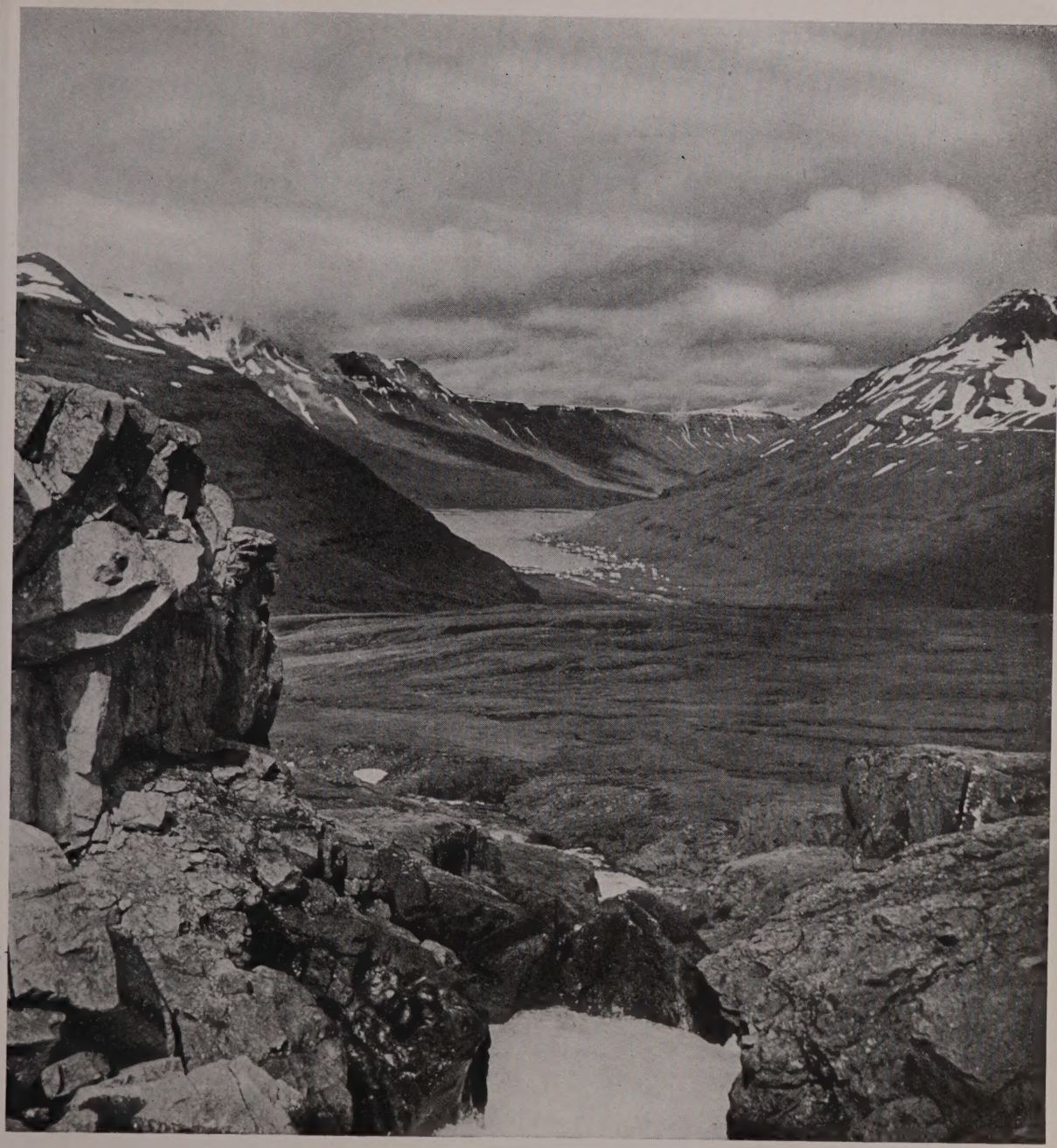
Meanwhile, the botanist had gone ahead with his own programme of work, a comprehensive survey of the present-day flora, and had an impressive collection of plants. His success emphasized our failure and as we had other work to do we decided to cut our losses and start on our next job—the surveying and geological mapping of a large igneous intrusion some thirty miles farther north. Accordingly, it was arranged for all of the party, except the photographer and myself, to travel to Seydisfjördur, with the equipment, by means of the ancient local bus. There was practically no road for most of the way and the technique of crossing rivers was to barge through at top speed while all hands clung grimly to the baggage. It was voted without exception the most dangerous trip of the whole expedition.

Meanwhile there was one possible fossil locality left in the area. During the war, when fuel was scarce, a search had been made for lignites, and although none had been found worth exploiting, there were reports of a small bed in an isolated mountain named Tungufell, nowhere near the "road" but between our present base-camp and Seydisfjördur. The photographer and I planned to trek over past this mountain to join the party at Seydisfjördur and search for plants in passing. We packed three days' supplies and set off at midnight to move while it was cool (there were twenty-three hours of daylight).

Early morning saw us camped by a small lake at the foot of Tungufell, and after four hours' sleep we set off, not very hopefully, on our search. We climbed the peak from all sides, up buttresses and down gullies, but not the slightest traces of fossil plants were found. Next day the weather was breaking, and



A. J. Thornton



M. Murray

The first glimpse of Seydisfjördur as seen by the photographer and leader of the Scottish Iceland Expedition during their trek over from Tungufell. Though only a small village (most of it appears in the photograph), it is the busiest fishing port in eastern Iceland and is visited regularly by Norwegian trawlers and smaller fishing craft. The houses lie at the head of the long narrow fjord and the 3000-foot mountains provide good shelter, even in the roughest of winter weather

The mountains of the eastern and western coasts of Iceland are composed entirely of almost horizontal basaltic lavas, with occasional intrusions of lighter-coloured acidic rocks (middle distance)

after seven hours of searching we reluctantly decided to give up and go back to the tent. Our last chance was gone because we had only one day's food left and we were twenty-two miles from the next base-camp.

We were scree-running down a steep gully when Murray kicked a piece of burnt wood and the hunt was on again. An ash band with woody layers was found, a few inches deep, hiding coyly under a nearby lava flow. After two weeks of searching in similar deposits we were not impressed, in fact it was so small that it looked decidedly uninspiring. We picked half-heartedly at it, meaning to give it a dutiful five minutes and then return to the tent.

Then I found myself staring unbelieving at the faint outline of a leaf showing through the muddy surface of the piece of rock I was holding. I carried it reverently to a small stream and, when it was washed, the midrib and delicate veins of a birch leaf were clearly seen. It was not a museum specimen but it was certainly identifiable. We worked inspired at the deposit till two o'clock in the morning, by which time the fossiliferous layer

was cleaned out and we had a good haul of leaves. (Fifty-two species of Miocene-Pliocene plants have since been identified, the first to be recorded from eastern Iceland.)

Next day the mist was so thick that visibility was reduced to a few feet. Using a compass we travelled over interminable mountain ridges, snowfields and scree slopes. It was hard going in the soft snow and loose rocks, but nine hours later we dropped down under the cloud level and saw Seydisfjördur spread out before us like a map. We joined the main party and spent the next two weeks at a permanent base-camp, surveying and mapping the intrusion. This was finished according to schedule and we returned to Reykjavík on August 14 to write up reports and prepare for the next trip.

The second part of the expedition took place in western Iceland, where our main interest lay in the volcanic phenomena. Iceland is almost entirely made up of volcanic rocks and few other countries offer such opportunities for the study of volcanoes : miles of lava flows, numerous hot springs and gaping fissures are characteristic. The famous Hekla has had twenty minor eruptions in historic times, the most recent being in 1947–8. The last large-scale eruption in south Iceland was in 1783. From a fissure over 20 miles long tremendous outpourings of lava killed off half the cattle of the island, causing a serious famine. Nothing quite so disastrous has happened since, but it is not impossible at any time. No-one is certain why Iceland suffers so much from such upheavals, but some geophysicists think that they may be caused by its geographical position at a point where two major zones of instability in the earth's crust intersect.

Everywhere there is evidence of recent glacial action which has gouged out many "corries" in the mountains. The surface of the rocks shows clearly the scratching and polishing caused by ice

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M. Murr

M. Murray

The main aim of the expedition was t find fossil plants from the easter part of Iceland. After weeks of search ing a richly fossiliferous layer wa found in a band of lignite near the foo of (above) *the mountain Tungufell. Th deposit* (left), *only a few inches thick was overlain by a series of thick lav flows, and was difficult to see eve a few feet away. From analyses of th pollen-grains and seeds found in th fine ash bands 52 species of Miocene Pliocene plants were recorded for th first time from this part of the islan*

Our first camp was at the base of a volcanic cone some fifty miles north of Reykjavík. It was only a matter of a few thousand years old, and it was perfectly symmetrical, with a breached wall through which lava had passed out to solidify in fresh blocky lumps for a distance of two miles. It was like a text-book example and we spent a week in the area surveying, photographing and collecting samples. We then moved farther north to camp in a great corrie under a high, shapely peak named Baula. This mountain was the most prominent landmark for many miles and it marked the spot where a large mass of liparite had intruded itself through the lavas.

We had two weeks left and we wanted to make a geological map of the area. However, the weather was deteriorating and our tents on the 2000-foot level were severely tested. It was now nearly the end of August, and a cold wind was blowing steadily from the north at half-gale strength. Sleet and snow showers swept down the valley, obscuring the cairns we had built for surveying. Even when it was clear enough for working the wind was so strong that two men had to hold down the plane-table while a third took the bearings. Some days the weather made it impossible for us to leave the tents and we adopted the technique of being prepared for any dry spell and rushing out to map and collect specimens at any odd hour. We often found ourselves working in the field at midnight and sleeping in the afternoons. By this opportunist method we managed to finish the map on a six-inch scale before the end of August, when we had to return to Reykjavík. The official expedition was over.

Everyone returned home except Dearnley and myself, who had for a long time been planning another trip—a sledge journey across the Langjökull, one of the interior ice-caps. We had with us a Swedish "pulka" sledge of new design which had been tested out by three members of the British West Greenland Expedition two years ago. It could be fitted with either dog- or man-harness, had three runners, and had a canvas cover to protect and hold the load. More reports were needed about its performance and we wanted to test it out for two men. We felt that two men might haul it on a frozen surface as easily as could three and, with more room for supplies, they would be able to remain out from base-camp for longer periods.

On August 31 we were camped beside a glacial lake at the south-east corner of the ice-cap. We planned to make a double traverse, once over to the western margin to photograph and note the distribution of the ice-cones, then back across and down the glacier Fremri Skridjökull. The margin of the ice-cap was badly crevassed and it took us most of the first day to relay the sledge and equipment up past the dangerous area onto unbroken ice. Fortunately we had light metal specimen-boxes to carry the food and valuables (compasses, camera and surveying instruments), but we were hampered by being roped together and lost time belaying each other over the more dangerous ice- and snow-bridges. Late that night we were camped four miles up the Hagafell glacier on solid ice.

Next morning we were off at dawn. The surface was frozen hard and the sledge moved easily. We had trouble at first with load-shifting as we bumped over small pressure-ridges built up by the slowly moving ice, but as we neared the top of the ice-cap the surface became smoother and we moved comfortably at a good walking pace. For days everything went according to plan. We reached the western margin, photographed the cones, and set off back on a compass-bearing for the eastern glacier. Sometimes the sun was hot enough in the afternoon to melt the top few inches so we slept in the heat and travelled at night under a full moon and a sky brilliantly lit by the Northern Lights.

One afternoon when we were more than halfway back a gale started. An icy northerly wind swept round us, blowing stinging sleet in our faces. It numbed us through sweaters and anoraks, and was so strong that we could not keep on course. At about five o'clock we were forced to halt and managed to build a low windbreak of blocks of ice piled on the sledge, before pitching the tent. The fury of the gale increased hourly and that night sleep was impossible. We took watches at holding the poles, which threatened to buckle, and inspecting the guys and pegs.

Next morning about eleven o'clock the gale reached its climax and no tent could have withstood it. By this time the single pole at the rear end of the tent had been subjected to such strain that it had cut through the groundsheet into the ice. The pole had buckled, and the slack in the canvas flapped madly in the wind. The inevitable happened, one of the panels began to tear, and we had to bale out through the side and collapse the tent before it was completely ripped to shreds. The wind was too strong to stand against, and we had to crawl on hands and knees to collect the gear together, and put the heavy specimen boxes on top of the tent to hold it in the lee of the

rnley

(Above) *In the summer dust-storms are common in the interior lava desert and the black volcanic dust is blown for miles onto the ice-caps. As the summer melting proceeds, thaw-streams collect the dust in patches and ice- or dirt-cones are formed, the ice under an accumulation of this material being much more slowly melted than the clean ice.* (Below) *The start of the ice-cap journey with the Swedish "pulka" sledge*

rnley

R. Dear

The happiest moment of the whole expedition—finding the sledge, food and equipment after the storm. Inside the metal specimen-boxes the instruments and food-supplies were unharmed and an improvement in the weather allowed the reloaded sledge to be safely hauled to the edge of the ice

sledge. We tried to open the boxes to salvage the instruments, but, even through our gloves, our fingers were numbed and we were losing body heat so fast that we knew that the only way out was to abandon everything, and move quickly to keep circulation going. We made an attempt to "rope-up", but found it impossible to manipulate the rope. A rucksack of food had already been prepared for emergencies, and our last desperate effort was made in stuffing the two sleeping bags and the log of the expedition into the other pack. Then, without map or compass, and visibility reduced to about two feet, we crawled and stumbled between gusts to the edge of the ice, where we made a rough shelter in some boulders and crept exhausted into our sleeping bags.

The gale continued all next day; we lay bruised, stiff with cold, and ate dry biscuits and raisins. Our food, stoves and paraffin were all lying at the sledge. Between us £140 worth of equipment had been abandoned, and there was nothing we could do about it. A lorry was due to come for us in five days' time, and we could only hope before then for a chance to salvage at least our instruments and food.

Meanwhile, we passed the time trying to work out the position of the sledge, and in making our shelter more windproof. Fortunately there was no fresh snow falling, and there was a chance that the site of the disaster could be seen if the weather improved. After two days the wind dropped as suddenly as it had started, and a heavy sullen mist lay over the ice-cap. We set off not very hopefully to look for the sledge, which we reckoned was about six miles in from the edge; luck was with us, the mist gradually cleared, the sun shone, and in a few hours we were sorting out the debris. After hot soup and pemmican the outlook was better, and instead of salvaging only the instruments and food, we loaded up the sledge completely again, and made a dash for it.

The bottom of the Fremri Skridjökull glacier was reached by nightfall; our scheduled journey was finished, a mere three days late.

A few days later, as we bumped back over the desert to Reykjavík, we caught our last glimpse of the ice-cap, serene and innocent in the mild autumn sunshine. We had seen it in all its moods. Contentedly we were ready to sail for Scotland next day, all our equipment intact for another time.

Newspapers in a Turkish Village

by MAHMUT MAKAL

The following extracts are from a book entitled A Village in Anatolia, *to be published shortly by Vallentine, Mitchell and Co. It has been translated by Sir Wyndham Deedes and edited by Dr Paul Stirling of London University, who has also supplied photographic illustrations. The sketches of village life on which it is based were published in Turkey in 1950 and 1952 and, while much that they describe is slow to change, some things are changing rapidly. For example, in 1950 there were 6000 tractors in Turkey as against 35,000 now; in the last year or two the number of radio receiving sets in the villages has expanded enormously; and the amount of window-glass to be seen, even in the poorest homes, has greatly increased.*

The author is a young schoolmaster who received his five-year course of training at one of the Village Teachers' Colleges and was then sent to teach at a village where, as he shows, the performance of his duties was hindered by the hostility of the devout. Some of these still oppose as irreligious the use of Latin instead of Arabic script, a change instituted by Atatürk in 1928.

The extracts here given have a special interest as throwing light on a question which will be analysed by Mr Francis Williams, formerly Editor of the Daily Herald, *in our October number; namely, what is the relative importance of newspapers in different parts of the world? The answer is of particular significance in relation to the less urbanized and industrialized countries such as Turkey, which has 40,000 villages and four-fifths of its 21,000,000 people working on the land.*

THIS is a village with a population of seven hundred. For the first time, this year, it has a school. When four of its walls had gone up, the Council of Elders decided to have it roofed in the way they wanted—with straw, reeds, mats, anything at all. Until that time part of the Mosque was being used instead; so they hurried to finish off the school quickly.

It was rather difficult to have ourselves housed in the Mosque until the roofing of the school building was done. The Imam [prayer-leader in charge of the village mosque] was adamant: "I'm not going to open the Mosque for you to run a school on infidel lines," he said. And whatever an Imam says, the congregation says too. The people of the village nearly had an uproar. As luck would have it, however, the district supervisor was very popular and his good words won them over. "He's not after women or girls—he's a decent fellow," people decided, and from that point on there was no further trouble. After having given lessons in the Mosque for two months, we took over that part of the school which had been roofed in.

"Anyway, you'd enough equipment?" you will ask. Nothing of the kind. Each child brought a sheep-skin and spread it on the mud floor. As for benches, blackboard, and that sort of thing, they might never have been heard of. Nor should you assume that all our difficulties were at an end once the school was opened. The next problem was to persuade the children's fathers to send them to school. If they were not agreeable, Law 4274 (on compulsory school attendance) didn't impress them at all. "You're a villager too, Efendi. You're one of us. I'm only saying this because you've made a good impression. But what's the point in putting the child to school? God doesn't allow a mouth that he's made to starve! He'll manage the same as his father did. Let him learn to follow a yoke of oxen and mind his own business. As long as he knows enough to look after himself while he's on military service, and to write a letter—that's all he needs. More than that is a sin."

Thank God, they knew something of the penalties of being unable to write on military service. If it hadn't been for *that*——! But there are not ten people in the village who have learnt to read and write while soldiering. In my enthusiasm I have even taught children to read a newspaper within a year. I'm convinced that one day the villagers themselves will find the cure for their ignor-

ance and illiteracy.

Where I live the greater part of my belongings used to consist of newspapers. They arrived in large quantities and were piled up in a corner. And yet now you couldn't find a single sheet even if it were to cure all ills. Only with the greatest difficulty do I save a few newspapers to protect my belongings from the dust. Some articles that I had meant to cut out and keep thus disappeared, too. People even make off with periodicals. The demand for large ones, like *Varlik* and *Village Post*, is tremendous. I didn't have the luck to save a single copy of *Village Post*. And what do you suppose they do with these newspapers? Don't imagine they read them to become learned. No! They stuff windows up with them. They turn up one after another and say: "Oh, Mr Teacher!—a newspaper! The children are getting frozen with the cold!"

"Indeed? And how have you been managing up to now?"

"Sir, we've been stuffing in rags and coats; but now so-and-so has put newspaper. We thought you would give us some, too. Paper looks a lot smarter, you know."

Who said that villagers don't appreciate smartness, if they have half a chance?

You may wonder where I get this passion for newspapers. When I left the primary school, and until I passed into the school to which I went afterwards, I had no notion even that anything was published other than schoolbooks, I mean newspapers, novels, periodicals, and so on. In the village I had memorized a few words without understanding them at all. For example, in natural science I had read something about "brick houses". In our village "brick" means those dried moulds of dung which are used for fuel in winter. For a long time I supposed "brick houses" to be made out of dried dung moulds. Then—I don't know how it came about—while in the third form, I suddenly got a taste for papers and periodicals. And how fond I got of them! Before long my passion was such that I got into the habit in my studies of not touching a lesson-book, so many periodicals did I read. It was as though whole worlds of fairy tales were disclosed to me in the pages of every newspaper, magazine, and book; and that terribly narrow world of mine became wider and wider, while with the learning of new things my thirst for study increased. For the first time I was learning to think.

It was just then that I got hold of the address of one or two periodicals and became a subscriber. I used to wait excitedly for the first of the month. Watching for the post became more and more of an obsession with me; and many were the arguments I had with the man who delivered the letters. He would throw down what he brought onto the office floor; and when two or three posts had arrived, if it occurred to the headmaster of the school, he would instruct the teacher on duty to deliver them. I got very worried. No-one noticed my state of desperation. There were times when I would snatch the magazines by force from the man on duty. When, through the window, I used to see those rolls of papers and magazines, all tied up with string, I worked myself into such a state that I felt like breaking the window to get at them. I used to pour out my troubles to the headmaster.

"Carry on with your lessons. You're a sensible young man—what do you want with newspapers?"

How my friends all laughed at me! What dreams I had for the future! I imagined that I was sent to a busy place. The post would come every day with books, newspapers, periodicals for me. Oh! I would be so happy! Yet things did not turn out as I had thought. I was sent to a village which was hard to reach from the town, and which itself had no road or rail connection. I knew I would have to wait in vain for my post. I subscribed to a few periodicals and newspapers, but I did well if one out of every four or five of them reached me. Every day I had to look about me for some villager going to the town. I would write a letter to the address which I had given to the papers and he would take it for me, if it didn't slip his memory. Often enough he forgot it, or couldn't find the address I had given him. The one I received most regularly was *Varlik*, and the first copy of that did not reach me till the sixteenth of the month, and frequently not till the month was over. Other magazines only came into my hands, roughly speaking, once in three or four months. God alone knows whether that was due to their not being regularly dispatched, or to their being lost on the way.

The magazines and books that I secured after such difficulties reminded me now and again that I was still alive but I was incapable of creating for myself any real joy or entertainment. I could not find what I longed for; my purse did not run to it. I longed for a gramophone. "Even if there were no change of records, it would play sometimes, and keep my ears from getting rusty," I thought. But no; no hope of that. A friend who lived in town, to whom I told my troubles, recommended a radio with headphones, saying that

it was cheaper than a gramophone. So I wrote to an acquaintance in Ankara. He announced that a radio with headphones, which would work in the village without any trouble, might cost 42 liras. At first I was delighted. I hoped that I should be able to manage it; but in the meantime exactly seven months passed, and by no possible means could I scrape together the 42 liras needed. In the end I gave up that idea, too.

This year, Sergeant Isa acted as Imam at B. . . . He teaches the children of that village. He came here yesterday on a visit to his family. Apparently the Sergeant never really believed that there was such a thing as radio.

"Sir," he declared, "how can it be possible —that the Call to Prayer should be cried in Egypt and heard over here? And think how many voices there are in the world, from morning till evening, all the world over! How is it that the radio doesn't get them all?"

We try to explain the working of the radio to him, but he's very obstinate.

"No. There's somebody hidden under that set where the talk is coming from. *He* does all the talking and tries to fool the public into thinking otherwise."

And he is not the only one who thinks like this.

From November, when winter sets in, until the ninth of March some people could still be found to go into the town. But they were just the few who happened to have some business in the Courts, who started off three or four days beforehand and rested at villages on the way. When such people come back we gather round them and ask the news; but the answer is always the same: "There isn't any news—except for this cold weather."

A certain provincial gazette arrives here, addressed to the village, and after a longish sojourn at the grocer's, finally reaches me; and there are usually one or two letters from men on service. Some of these, which found their way to the village after collecting their share of dust, had been written last November; some asked for socks, some for gloves, some for money. I handed them over to the fathers of the writers on March 25. The paper (*News*, as it is called) is more impatiently awaited by the villagers than by me. "Read it, sir," they say. "Read it; tell us what it says."

"It seems to be just the wrong paper for here," I say. "There's nothing in it to help us."

But they are not convinced. "That's what you always say. All the same, you find a good deal of news and explain it to us." Come what may, you have to read and explain it.

"Very well," I say, and I begin to expound. "The General Director of Statistics has started on the problem of ascertaining how many dogs there are in the country. . . ."

"Hm! That's bad for our dogs. They'll go and destroy them again! That's not good news, sir. But go on—let's hope there isn't going to be another war? Have the Russians gone mad again?"

I continue to read, and tell them that the Russians, not to be outdone by the Americans, are going to found an Eastern *bloc*.

"They would! They would do anything. Ruin on them! Read on, sir."

"Here's something more. Five travellers have been frozen to death on the Kaz Mountain."

"That place seems to be worse than this." This is the signal for reminiscences and friendly discussion about how many people have been frozen to death at such-and-such a place, on such-and-such a date. "And now tell us what else there is."

The paper is a provincial one, a one-page thing. Five or six weddings fill the first page. I tell them: they are amused.

"Who are we, that we should have a newspaper? Isn't there anything else? So-and-so married, so-and-so engaged! That's not worth reading or listening to."

The villager is not learned; but he is intelligent. I have known a great many, whose comments on the news they have heard would shame those people we vaguely call "cultured". The problem is to put the right kind of publication into the hands of the villager: are we going to tackle this problem, I wonder? It is as important as village education. Then I saw in that same paper the phrase: "Prime Minister Shemsettin Gunaltay." I felt taken aback. What had happened to Hasan Saka? When did the change take place? Has the whole Cabinet changed, perhaps?

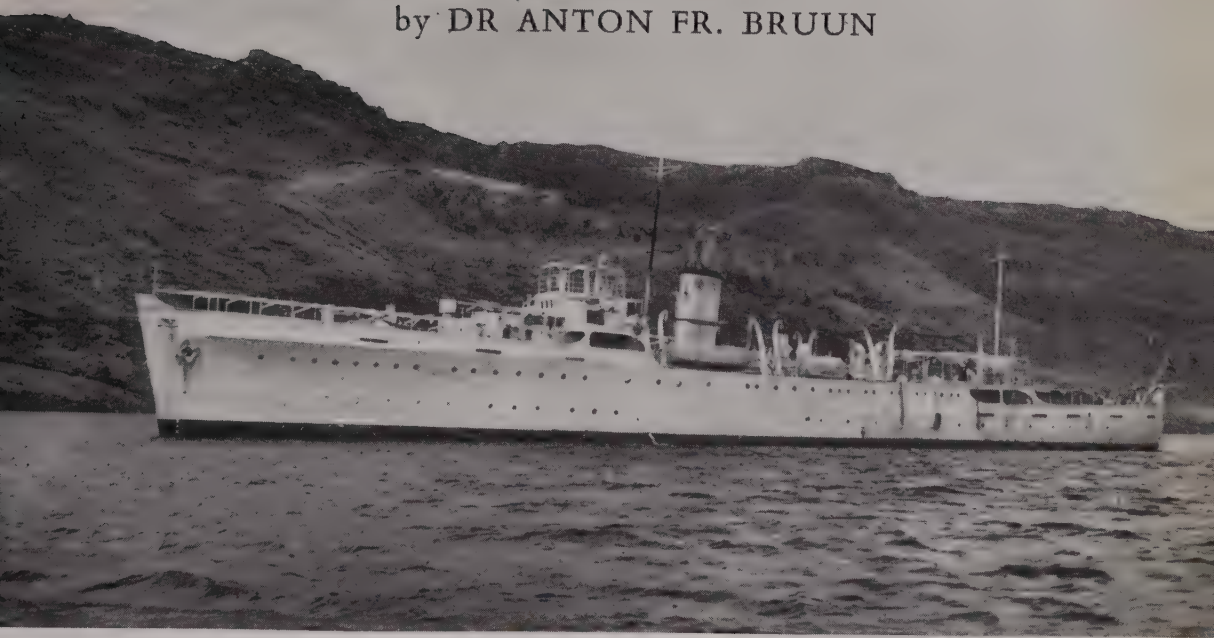
"Hasan Saka has resigned the Premiership," I said.

"Is that the man who put up the price of sugar?" asked somebody. "Anyway, we don't do any business in sugar. What's the new fellow like?"

In time, I discover that the change of Cabinet took place in October. Only by chance, in the following March, does a village like this learn that there has been a change of Government!

Problems of Life in the Deepest Deep Sea

by DR ANTON FR. BRUUN



All photographs from Hakon Mielche, Galathea's *Information*

The Royal Danish Navy's research ship Galathea *at Campbell Island, south of New Zealand*

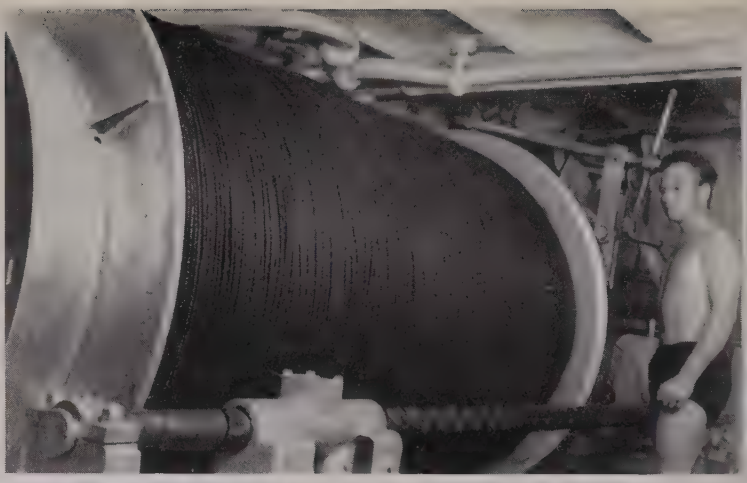
The author was Scientific Leader of the Danish Galathea *Expedition, which, following a century-old Danish tradition, undertook a round-the-world cruise of deep-sea exploration from 1950 to 1952*

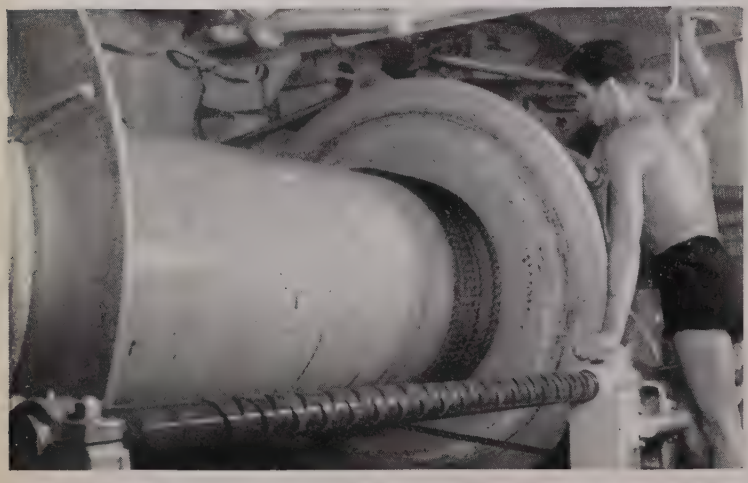
A FISH, some brittle-stars and a few other small animals caught in a trawl about fifty years ago by Prince Albert of Monaco were taken at a depth of 6035 metres, just two hundred metres deeper than animals trawled by H.M.S. *Challenger* on her classic deep-sea expedition of 1872–6. It is astonishing that this small increase on the previous record remained the greatest depth from which evidence of life in the sea had been obtained until 1948; but it meant that animals might be found over 98 per cent of the sea bottom which itself covers two-thirds of the earth's surface.

The remaining 1·3 per cent, representing oceans with depths exceeding 6000 metres, right down to the record depth of 10,863 metres recently reached by echo-soundings by the old *Challenger*'s namesake, was an unfished area, and quite a big one: 4,700,000 square kilometres or twenty-two times the area of Great Britain. Nowadays, when man claims to know his planet, this is in itself a challenge and an even greater one for a biologist considering the problems of life for animals living 10,000 metres down, under the tremendous pressure of water masses of 1000 atmospheres. We knew that animals have adapted themselves to the ice-cold conditions of the Arctic, to the burning heat of deserts and to the low barometric pressure of high mountains. But could they also withstand the highest pressures of the greatest depths of the ocean?

Even a single haul made by the Swedish Deep-Sea Expedition of 1947–8, under the leadership of Professor Dr Hans Pettersson, in the Atlantic at 7625–7900 metres, bringing up a few animals of various species, gave no final answer. Laboratory experiments and conclusions drawn from our knowledge of physiological processes had led scientists to assume that there might be no life at depths greater than 8000 metres. If this was so another fas-

An especially powerful winch was fitted aft on the deck of Galathea *to take the strain of hauling the 12 kilometres of wire and the gear attached to it, which were used for trawling in the deepest sea. The wire was stored between decks on the drum of* (right) *a second heavily built winch. All the wire had to be paid out* (below) *when fishing in trenches 9000 to 10,000 metres deep*





(Below) *The sledge-trawl, 6 metres wide, being lowered into the Kermadec Trench. A simple framework of galvanized-iron tubes, to which three broad runners were fixed, allowed the trawl to slide along the bottom irrespective of which side struck the bottom first. Two bags were used to lessen the risk of losing the whole catch in the event of the net being torn on a rock. In fact only one bag came up again on some occasions*

(Right) *Dr B. Kullenberg, the Swedish physicist, showing the apparatus that he constructed for obtaining cores of the sediments from the bottom of the deepest sea. It consists of a steel tube with a plastic inner tube fitted with automatic valves above and below. The upper swelling is a load of 50 kilogrammes of lead to get the corer to penetrate as deep as possible. It takes great skill on the part of the navigators to get it absolutely vertically down at 10,000 metres.* (Below) *With this Professor ZoBell, of the University of California, was able to take samples of mud to make cultures of bacteria. From one such core he found bacteria living in the sediment 75 centimetres below the surface of the sea bed at a depth of 10,000 metres. Several foreign scientists visited the expedition aboard the* Galathea*: (left to right) Drs T. Megio and R. Medina (Bureau of Fisheries, Manila), Professor ZoBell, the author, Dr Bent Hansen and Professor T. Gislen (University of Lund, Sweden)*

cinating possibility could be imagined : dead organisms from past thousands, perhaps millions, of years might have sunk to the bottom of the oceanic trenches; they might even have remained little altered in a sterile abyss in the absence of bacteria to cause decay. In any case dredging and trawling at the greatest depths—if that were possible—would be bound to prove of the utmost interest.

* * * * *

It was just before dawn, though still pitch dark, but the after deck of the Royal Danish Navy's research ship *Galathea* was flooded with light. Deep down in the clear sea the pale outline of the big triangular bag of the sledge-trawl could just be seen, and the fish-master followed its ascent from the deep, ready to give the attendant at the trawl-winch the sign to stop. Everything went with the even rhythm of long practice and close collaboration. So far I felt completely happy, but the few moments that morning until the trawl was on the deck and the bag opened seemed like hours to me. For the first time since we left Denmark we had paid out the whole length of our 12 kilometres of steel wire in an attempt to fish at the 10,190 metres which our echo-sounder had registered below us. We were in the Philippine Sea, over the Trench itself, working our station number 418 on July 22, 1951.

In those minutes before the trawl broke surface I was still prepared for the disappointment of seeing the bag full of pelagic, or surface, animals only. But it was a great relief that the wire stood up to the enormous strain. Our calculations at home had proved to be correct, the whole wire was on board again and we could make another attempt.

Then somebody exclaimed : "There's mud on the frame. The trawl has been on the bottom!" And then : "There are stones in the bag!" Everyone on board who could crowded around with eyes fixed on the man untying the cord that closed the bag. The contents were taken out very cautiously. We hardly noticed the beautiful red prawns, some fish with luminous organs or the jelly-fish, because we all knew that they were just pelagic animals caught in the free water masses while the trawl was hauled through the many kilometres of water between the bottom and the surface. But there, on the largest stone, were some small whitish bodies—sea-anemones (actinians). Even if no more animals from the bottom were found, this haul would remain the most important of the whole expedition, because here was proof that animals can live at a depth of 10,000 metres, at 1000 atmospheres of pressure. No wonder everyone was overjoyed when the mud in the canvas bag had been sifted and all the meshes of the trawl had been carefully searched, for we found about 25 sea-anemones, 75 sea-cucumbers (holothurians), 5 bivalves, one crustacean (amphipod) and a worm (polychete) : an unexpectedly rich variety of animals from the bottom of this deep trench. There could be no doubt that the animals were from the bottom itself, and fortunately it was also certain that the depth was 10,190 metres. We had navigated carefully according to the configuration of the trench as we had charted it after several days of echo-sounding. The Kelvin and Hughes apparatus had worked perfectly, giving a clear track on the recording paper : the navigating officer had calculated the drift of the ship, through wind and current, so well that we had moved above the narrow gorge just at its deepest.

Our good ship, the *Galathea*, was formerly H.M.S. *Leith*, built at Devonport and converted into a research vessel in the dockyard of the Royal Danish Navy which also provided the crew. She took her name from the naval corvette *Galathea*, which also carried a scientific staff on the first Danish round-the-world cruise in 1845–7. So a century-old tradition of happy collaboration between the Royal Danish Navy and Copenhagen University was kept alive. She displaced 1630 tons, a very suitable size, not too big for easy manoeuvring while operating in the deep-sea fishing seas yet big enough to accommodate the whole complement of about a hundred men as well as the laboratory and scientific equipment.

The choice of the ship's commander was an easy one : Captain S. Greve, Royal Danish Navy, had served as a young lieutenant on the two years' cruise of the Danish research vessel *Dana* on her circumnavigation of the world in 1928–30, when Johannes Schmidt was searching for the breeding places of freshwater eels, and I was a young assistant zoologist.

A special committee headed by H.R.H. Prince Axel was in charge of the whole organization of our expedition. The scientific costs were paid for by the Danish Expeditions Fund (President, Vice-Admiral A. H. Vedel, Royal Danish Navy) and the Danish Government granted the necessary means for the running of the ship during the cruise.

It is a simple matter to fish in the deepest sea : a good ship, a long wire and an ordinary trawl of some sort are the only requirements;

All colour photographs are Ektachrome

The otter-trawl (of a type used for herring-fishing) was difficult to photograph in action. It is seen at an exhibition of the results of the Galathea *Expedition. The mouth, 32 metres wide, was kept open by two otter-boards to which the tow-lines were attached. The underside of each board was weighted with 150 kilogrammes of iron to get the trawl down exactly in the position shown*

but it must also be immediately admitted that this is not the whole story. Such fishing was not possible until after World War II, when the development of registering echo-sounding apparatus reached its present state. From it we have learnt that extensive plains in the deep sea are as rare as on land. The old method of spotwise sounding, with lead and wire, is of little use for fishing in deep water, for which reliable information is needed about the depths at which the animals are taken. When you come to the greatest depths it is no use at all because they may vary by several thousand metres within a short distance.

A very long wire is essential for trawling in deep water. We chose to have one made in a

The fishmaster and two sailo aboard the Galathea *lowering t 6-metre sledge-trawl; three m men worked the winches. To t left of the fishmaster is t bottom-grab which covers an ar of a fifth of a square metre a is used for estimating the dens of worms, crustaceans and oth small animals in the mud. The b sheave suspended from the hea 'gallows' carries the steel w from the winch into the sea. T minimum time for a successful ha at 10,000 metres was fourteen hou during only two of which the tra was being towed along the botto*

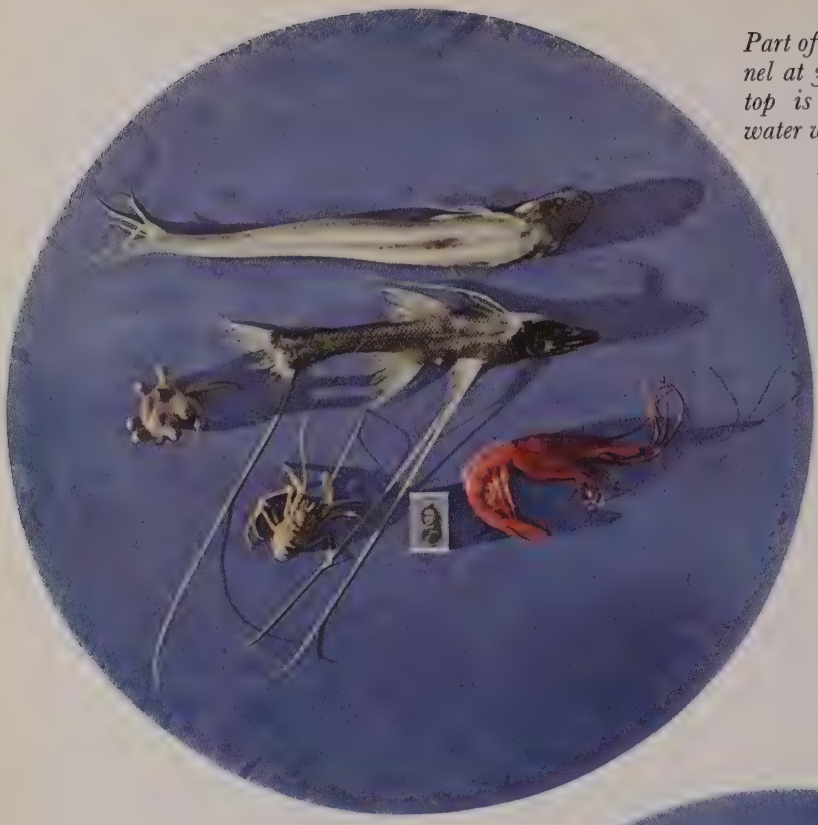
A very successful haul with the 32-metre otter-trawl from 3600 metres being taken on board. So as not to run any risk of losing the precious catch, the dinghy has been launched and the fish-master is securing the bag with ropes. Deep-sea work needs careful planning to obtain the most favourable seasonal weather conditions along the route. With thousands of metres of wire paid out the ship is hard to steer, so an efficient meteorological service has to be maintained in order to avoid being caught while fishing by sudden strong winds

A preliminary survey of a good catch. The red crustaceans and black fishes are mostly caught between the deep sea bottom and the surface; the pale starfishes and sea-anemones in the yellow dish in the foreground are typical animals of the bottom of the deep sea. The whole catch must be preserved in formalin or alcohol immediately to avoid putrefaction in the tropical heat

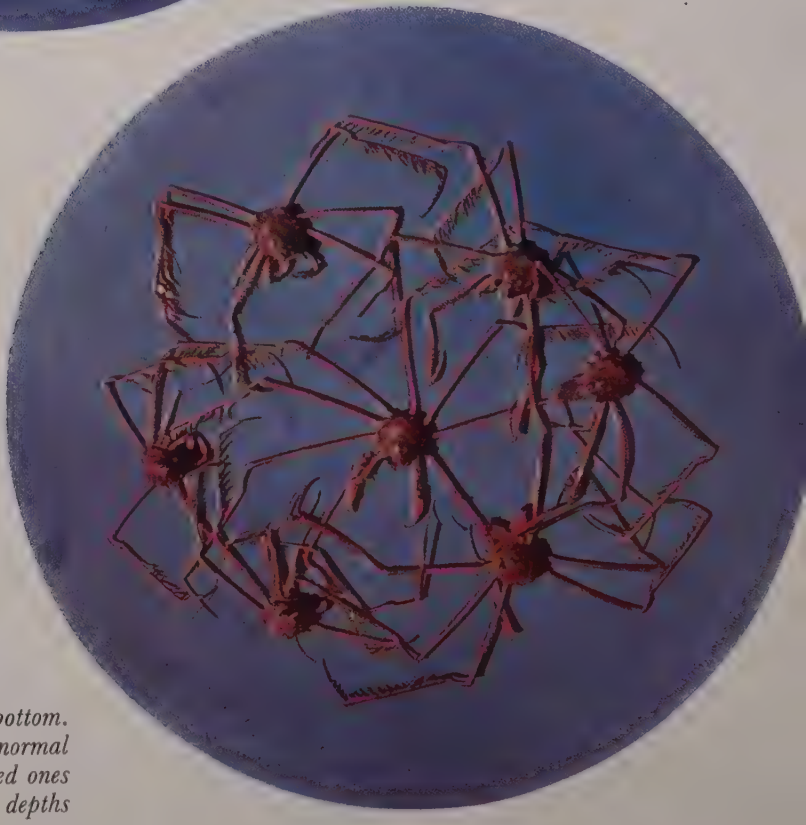
single length of 12 kilometres, with a breaking strength at its weakest point of 4·5 tons. This meant that we could pull gear with a force of up to 1·5 tons as we wanted a safety factor of 3. Even with a wire tapered from 9 mm. in diameter at the bottom end to 22 mm. at the upper the weight is about 9 tons and the breaking strength has to be about 34 tons. There is no difficulty in getting a trawl down, because a wire sinks to the bottom, just as a stone does, in deep or in shallow water at a speed depending on the difference in specific weight between the sinking object and the surrounding water. When one fishes in shallow water one can feel the trawl strike the bottom but this is not possible

(Above) "*But there, on the largest stone, were some small whitish bodies—sea-anemones (actinians). Even if no more animals from the bottom were found, this haul would remain the most important of the whole expedition, because here was proof that animals can live at a depth of 10,000 metres, at 1000 atmospheres of pressure.*" *It was also surprising to find stones mixed with the mud in the Philippine Trench.* (Right) *A clutch of eggs of a deep-sea octopus on a piece of driftwood*

The biggest haul at about 3600 metres was made on the Pacific side of Central America. An abundance of food is produced in the surface layers and plenty of plant material is carried from shore out to sea where it sinks to the bottom, to form a sediment rich in organic components. These serve as nourishment for bacteria, which in turn sustain such animals as worms and bivalves; ultimately providing food for (above and left) *quite large fishes. In the hands is a sea-cucumber* (*holothurian*)



Part of catch from the Mozambique Channel at 3400 metres. The fish second from top is especially characteristic of deep water with its reduced eyes and enormously prolonged fin-rays which probably serve as feelers. To the left is a hermit crab with a colony of sea-anemones and below a squat-lobster and a red deep-sea prawn



Crab-like crustaceans, Platymaia, *from a depth of 660 metres off South-East Africa. The very long legs with a fringe of fine hairs allow them to walk around without sinking into the soft muddy bottom. At this depth eyes are generally of normal size, in contrast to the much reduced ones of animals that live at very great depths*

Scientists on a deep-sea expedition have to work day and night, keeping watches. Eleven could operate at the same time in the laboratory: zoologists busy examining and preserving specimens, chemists making analyses of the sea water, physiologists experimenting on plankton and bacteria. As Galathea *was very steady microscope work could be carried out even when the sea was rough*

in deep water.

It used to be a question of trial-and-error to discover how much wire should be paid out to get a trawl to the bottom. On the Swedish Deep-Sea Expedition, however, Dr B. Kullenberg, the physicist, worked out a theory about the curve formed by a certain wire, dragging certain gear at a given speed along the bottom. We were able to make full use of this, especially since Dr Kullenberg had accepted an invitation to come with us part of the time. From simple curves based on very complicated calculations from his formula, fishing is reduced to a matter of paying out the wire needed for the depth and the type of gear used and the speed (usually 1 to $2\frac{1}{2}$ knots) along the bottom; then the ship must be kept at a constant speed which gives a fixed angle between the wire and the surface of the water. This meant that we could disregard wind and

While steaming to the next fishing place the latest catch is examined and preserved in jars for further study at home; the bigger animals being deep-frozen in a special store. The seven young Danish zoologists on the expedition were equally happy whether studying the unknown sea-depths or going ashore on remote and rarely visited islands—in fact fulfilling their boyhood dreams

current in the surface layers which otherwise always play tricks in deep-sea fishing. We followed this method with very good results, even to the extent of sometimes making the propellers go astern because wind and current would have swept us along too fast. A fisherman from an ordinary trawler would undoubtedly be astonished, as our fishmaster was the first time, when we ordered the propellers astern and maintained that the trawl was being towed forward at a speed of 2 knots along the bottom, but a fine haul convinced him that we were right in trusting to the curves. It has to be borne in mind that the trawl must touch and follow the bottom. Even if it is only 10 metres above it, the haul is a failure. The practical application of Dr Kullenberg's theory is therefore a great advance on the earlier methods of deep-sea fishing and gives far fewer failures.

Our largest trawl was 32 metres wide, an ordinary light otter-trawl of the type used for fishing for herring or prawns in Danish waters. Hitherto dredges or small beam- or sledge-trawls have mainly been used in deep-sea investigations, though the Swedish Deep-Sea Expedition succeeded in making some hauls with a 10-metre otter-trawl. We were limited by the length of our wire in the use of our big trawl to depths not exceeding 7500 metres but this was quite sufficient to prove that no large fast-moving fish lives at that depth.

The heavy winch for trawling was specially built for the Swedish Deep-Sea Expedition and taken over by the *Galathea* Expedition which it served extremely well.

Our expedition left Copenhagen on October 15, 1950 and headed southwards in the Atlantic. Although our ultimate purpose was to examine the greatest depths it was thought important to investigate all the areas we passed through, especially those with depths exceeding the average of the oceans, 4000 metres. The North Atlantic is comparatively well known, so work did not start until the Gulf of Guinea, off the west coast of Africa, but from then onwards it went on almost continuously until we returned to the Atlantic in June 1952.

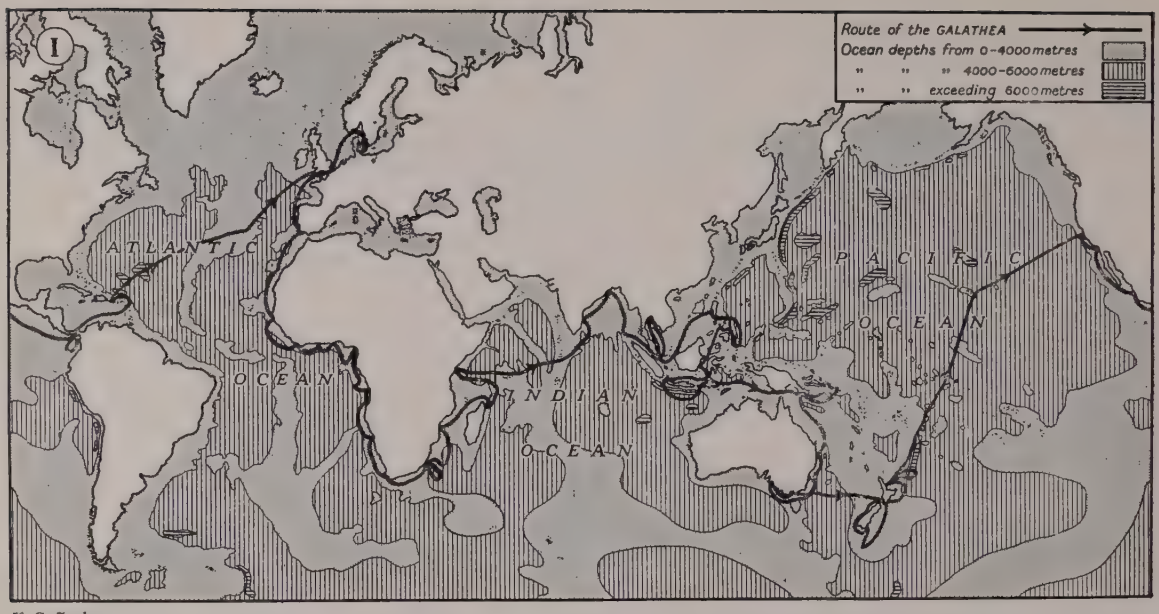
Now and again some fishing was carried out at relatively shallow depths of up to 400 metres to obtain collections for comparison with the deep hauls. In addition we observed the temperature and salinity of the sea water to obtain information about the environment of the animals. In this connection even the surface layers were studied, especially with regard to the problems of food-production. The reason for this was that just as man or any other animal on land depends on food directly or indirectly produced by plants, so animals in the deepest ocean must have food originating from the same source. In the oceans the plants are the microscopic floating algae which live only at most in the top hundred metres or as far down as the rays of the sun penetrate and can be assimilated. It is the interaction between the energy of the sun's rays, the living plants and the fertilizers that creates new plant material, new food.

For this reason we examined the amount of the most important fertilizer, the phosphates, and the amount of light in the various surface layers. Samples of plants, the so-called phytoplankton, were collected and submitted to special experiments in the laboratory to study their productivity. Another young student on Johannes Schmidt's world cruise, now Professor E. Steeman Nielsen, has developed a very ingenious method by which the invisible plants in samples of sea water are made radioactive and the quantity of organic matter produced by them is ascertained by means of a Geiger-Muller counter. From observations carried out for the first time in all oceans Steeman Nielsen has calculated the total annual production from all seas of organic matter or food to be about 40,000,000,000 tons or the same as the estimated total production of all land. This information about the basic food is not only most important because of its bearing upon the utilization of the resources of the seas but is also of immediate interest to us in its relation to our deep-sea animals.

It is commonly, though probably erroneously, supposed that a 'rain' of dead organisms sinks towards the bottom of the sea. In Nature any animal that is weak either from disease or old age is soon eaten by more vigorous ones. Therefore only organic matter such as excrements sinks down; this is of little immediate use to the animals at the bottom but forms an important source of energy for a rich bacterial life. Professor Claude E. ZoBell of the Scripps Institute of Oceanography, California, was a member of our expedition while it was working in the Philippine and Sunda Trenches and the Banda Deep, where he was able to cultivate a great variety of bacteria from samples of mud. These he terms barophilic—pressure-loving—because they only reproduce when kept in cultures under pressure as high as that at the bottom of the sea. ZoBell reported his first successful cultures on the very day on which we made our first trawl in the Philippine Trench, so we were at once able to understand how the holothurians and bivalves that we brought up feed : they eat the mud and draw their food from the bacteria it contains.

An important source of energy for the bacteria is drifting wood, branches, leaves and fruit such as coconuts which are washed out into the ocean by rivers or tidal currents from mangrove swamps. All of these eventually fall to the bottom, and we found such debris even in the Philippine Trench. Wherever we found a large amount of plant material we always had rich hauls of animals.

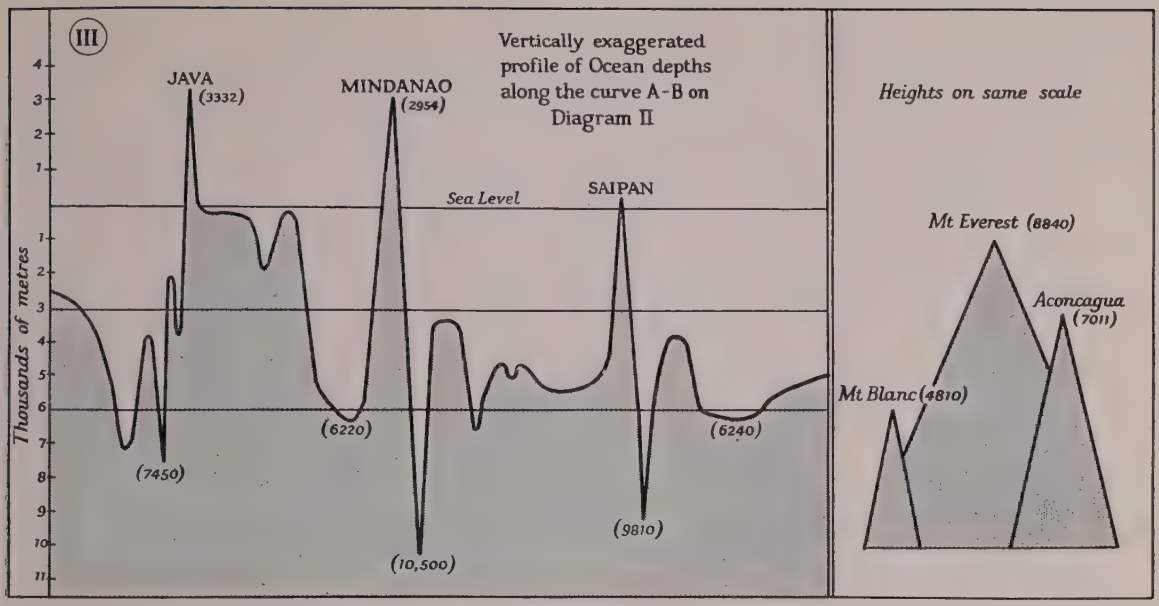
An important conclusion can be drawn from these observations : the abundance of animals in the deep sea is closely connected with conditions in the surface layers, which determine the richness of phytoplankton, and the currents bringing plant material from the land.



K. C. Jordan

Diagrams I and II. Only 1.3 per cent of the ocean bed lies at a greater depth than 6000 metres, but it is still an area twenty-two times that of Great Britain. During her two-year voyage the scientists aboard the Galathea *investigated the possibility of animal life in this area, giving special attention to the ocean depths between Australia and Asia and in the south-west Pacific. The profile in Diagram III illustrates dramatically the difficulty of trawling the bottom of the "trenches" and "deeps" in that region, where the depth may vary by several thousand metres within a short distance*

K. C. Jordan



K. C. Jordan

(Above) *A drawing by Joyce Allan and G. P. Whitley of* Bassogigas, *a brotulid fish 17 centimetres long, caught at 7130 metres in the Sunda Trench. It is the only fish ever found living so deep.* (Left) *A collection of plant fragments from 5100 metres in the Celebes Sea, including two coconuts, a piece of bamboo and some mangrove-tree fruits. Whenever such material was brought to the surface a rich haul of animals would be found, an indication of a good supply of food*

Steeman Nielsen found that even very clear water with few algae, like that of many tropical seas, produces some food, which means that there are no barren deserts in the ocean. We found that the same applies to the bottom: wherever we attempted fishing we always got some animals even if we only lowered a special grab covering a fifth of a square metre and sifted the mud brought up.

There are also many cases of interchange between the surface layers and the deeps, in which animals living and growing at the bottom rise towards the surface to breed. The deep-sea eels such as *Synaphobranchus* are an example of this. They become larvae, as do the freshwater eels, at a particular stage in their development during which these "leptocephali", as they are called, grow up in the sunlit surface layers where they find a rich variety of minute animals for food. When the leptocephali metamorphose into small eels they seek the bottom deep down where most of them form a welcome supplement to the diet of hungry bigger fishes.

While many groups of invertebrate animals are found at the greatest depths we found only one fish as deep as 7130 metres, at which depth the big trawl brought up a very rich haul in the Sunda Trench, consisting of over 3000 animals, mostly holothurians, and this single fish. It was 17 cms. long; except for the minute eyes which are undoubtedly functionless its general appearance is not very striking although it belongs to a great family of fishes, the brotulids, which have a variety of representatives in the deep sea, including totally blind species. We got fishes in only one other haul in depths exceeding 6000 metres; in this case five specimens belonging to another family, the liparids or sea snails, which has two representatives in British waters. In contrast to the shallow-water species our deep-sea specimens had rudimentary eyes, and the sucking-disc formed by the fused ventral fins was also much reduced. Neither eyes nor sucking-discs are of much use in the darkness at the muddy sea bottom.

Although no fishes live at the greatest depths we found many different kinds at depths between 4000 and 6000 metres, their characteristic features generally being a pale colour and eyes often reduced to useless organs. There is not the endless variety found in the bathypelagic fishes (i.e. those living in the free water above the bottom but below the sunlit layers) which have many different kinds of luminous organs, with specially adapted eyes and life-habits.

The bottom fishes of the deep sea are true denizens of the deep; when they are brought to the surface they are dead like all other deep-sea animals, but they have not exploded as is often supposed. As a matter of fact it is only fishes from moderate depths that do something approaching this: having a closed air-bladder the air in it naturally expands when they are hauled to the surface. Deep-sea fishes have no air-bladder, and the body fluids and tissues alter in volume so extremely little under lower pressure that we are justified in assuming that they look much the same to us as they did when they were alive, deep down. Naturally their delicate bodies are often much damaged, almost torn to pieces, especially when there is a quantity of stones, pumice or shell in the trawl. But in most cases the change from the calm deep with temperatures constantly about 1° to 2° C. to the hot surface water in the tropics is bound to be fatal as a result of some sort of heat-stroke.

In contrast to the fishes some worms and holothurians are able to live at, for instance, a depth of 100 metres as well as at 6000; it is still to be discovered whether this means that we are only able to see the shape of the animals and not some special chemical or physiological difference. We were astonished to find in the Sunda, Solomon and Kermadec Trenches a common holothurian, *Elpidia glacialis*, which was hitherto considered characteristic of the Arctic Basin.

Many details remain to be studied by specialists before the results of the *Galathea* Expedition can be summed up. We brought back several thousand specimens of well over a hundred species from depths exceeding 6000 metres, from which, previously, only some twenty specimens and some six or seven species had been found. From the rest of the deep sea we have an uncounted number of specimens and species, many of which have never been found before, or not since the days of the *Challenger*. Thus a wealth of new observations will appear in the scientific reports which are beginning to be printed.

The study of Professor ZoBell's barophilic bacteria has been the key to the understanding of life-processes under high pressures; this in itself may throw some surprising light on our whole conception of life.

We are happy that Denmark has once again taken her part in the study of the oceans, but the wake of the *Galathea* is only a tiny streak around the world. Many more such expeditions are needed, for so very much is still unknown about the Seven Seas.

The Ocean Stream

III. Ocean Currents and Animal Life

by F. D. OMMANNEY

The author, whose twenty-four years of scientific research have taken him to the Antarctic, Arctic and Indian Oceans, surveys for us in a series of three articles the causes and character of ocean currents, how they differ from one another, and their effects on human and animal life. The first two of these articles were published in our July and August numbers. Dr Ommanney's non-scientific publications include South Latitude, The Ocean *and* The Shoals of Capricorn

THE water movements mentioned in the preceding articles, except in relation to the Southern Ocean, are those which involve only the upper layer within the influence of the prevailing winds. This upper layer naturally varies in thickness from place to place according to the strength of the prevailing wind and to the volume of the mass of moving water. In general it may be said that it is nowhere deeper than about 150 fathoms. Below that depth movements of water are massive, ocean-wide and very slow. The controlling factor which causes them is variation in density, itself a result of variation in salt content or temperature. In the far south cold dense water sinks down against the coast of the Antarctic Continent and creeps slowly northwards in the great depths of all the oceans. In the northern hemisphere cold water sinks down against the ridge that almost cuts off the Arctic Sea from the Atlantic and, in the Pacific, against the coast of Alaska and northern Siberia. It moves slowly south in the deeper layers as a mass of water thousands of fathoms in thickness, compensating for the northward flow of the Gulf Stream in the Atlantic, and the Kuroshio Current in the Pacific. Generally speaking, more water moves north than south over the surface of the oceans and, at depths below 150 fathoms, more water moves south than north. The simple plan of circulation, which is preserved in the southern hemisphere but distorted by the presence of land masses in the north, is that water flows away from the Poles at the surface and at the bottom, but in the south there is an intermediate layer between these two of water flowing away from the Equator, sinking towards the Pole.

All these water movements, both vertical and horizontal, at the surface and at great depths, have a profound effect upon the living population of the sea. Not only do they maintain the nutrient salts in constant circulation, but they also ensure the adequate oxygenation of the water at all depths, even at the greatest. Further, by ensuring that one stratum of the environment is compensated by another moving in a different direction, the population is given stability. If helplessly drifting small creatures lived in water which was in movement always in one direction the whole population would soon be swept away altogether. As it is, a mechanism is provided whereby the population, possibly as eggs, larvae or resting stages, can be carried back to where it came from.

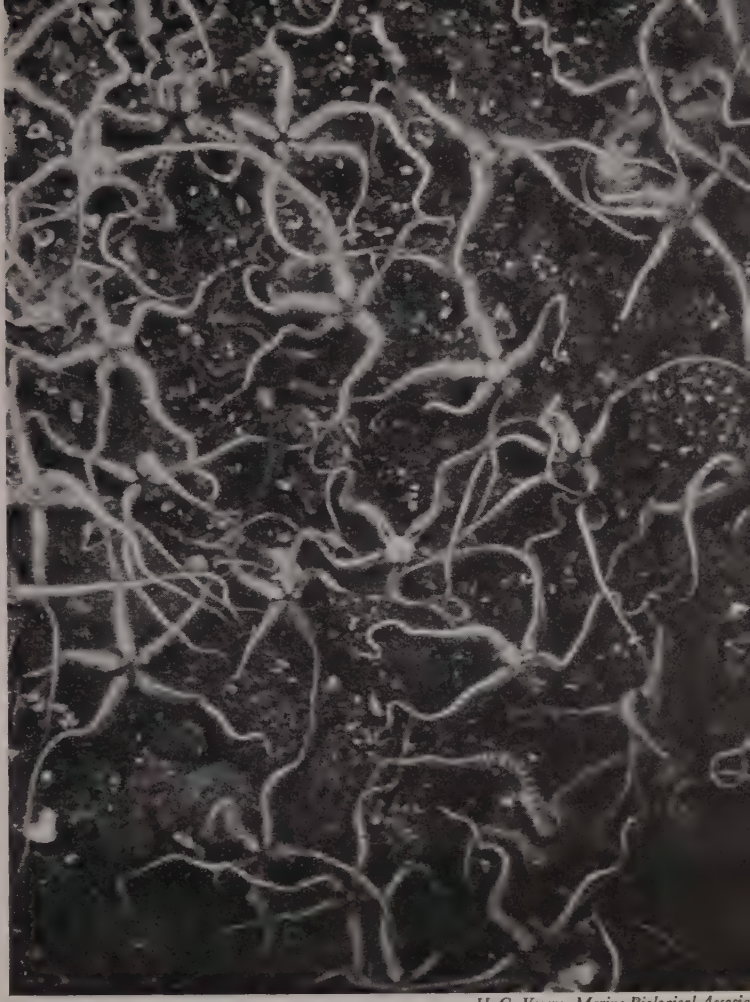
The sea is believed to be the birthplace and cradle of life. It may be supposed that the interaction of molecules in warm shallow water, lit by the sun and rich in salts dissolved from the rocks and from the soil, produced—and may, indeed, be still producing—the specks of naked living slime (protoplasm) from which arose the lowliest creatures living in the sea at the present time. From them has evolved a vast diversity of animal and plant life. Some of these living things have left the sea for the land by way of the shore and the estuaries to continue the story which has its climax in mankind.

The great population of living creatures in the sea, with the whales and fishes at its head, may be divided for convenience into three classes according to the habit of life of each class. First, there are the creatures that crawl over, or burrow into, or cling to the bottom or to the rocks of the sea's margin. These are known collectively as "benthos" (Gr. *βένθος*, the deep) and the class includes such animals as worms, cockles, sea-urchins, starfish and anemones. Secondly, there are those which can actively swim from one place to another, such as fishes and whales. This class is known as "nekton" (Gr. *νηκτόν*, swimming). Thirdly, there is the largest and most important class

s P. Wilson

Benthos (bottom-living creatures) on an exposed rocky shore. Some, pounded by waves, find protection in a compressed shape (limpets), an adhesive foot (anemones), a fibre or cement attachment (mussels, barnacles); some, left dry by the tide, keep moist in their shells or retract their bodies. Dwellers in rock pools (below) *can withstand wide variations of temperature and oxygen content of the water*

s P. Wilson



At greater depths benthic life is more tranquil and is extremely prolific so long as the bottom is suitable for crawling, clinging or burrowing and currents move the water. (Right) *Brittle-stars on a muddy sand and gravel bottom at a depth of 55 metres near Plymouth. The longest dimension of the area covered by this photograph is 50 centimetres and it shows a population of brittle-stars crowded together at the rate of over 100 individuals per square metre or 400,000 per acre. Tidal streams carry a flow of suspended material across their food-collecting net of tangled arms*

H. G. Vevers, Marine Biological Associa

of the three, the myriads of helplessly drifting, often microscopic, life, both plant and animal, known as the "plankton" (Gr. *πλαγκτόν*, wandering).

The plankton is the basis of all marine life since it is the food, often at one or two removes, of all animal life in the sea. Thus, the great ninety-foot whale feeds on swarms of small shrimp-like "krill", which belong to the zoo- or animal-plankton. These, in their turn, feed on the drifting unicellular plant life, known as "diatoms", which proliferate in countless millions in temperate waters. These belong to the phyto- or plant-plankton. They form the pastures of the ocean and it is to them that the English Channel owes its familiar green colour.

The animals of the plankton feed on each other and on the diatoms and other members of the plant-plankton. These require sunlight for the photosynthesis which is for them a fundamental life-process. It follows, therefore, that the plankton is found most abundantly in the upper layers, the top 50 fathoms or so, within the range of penetration of sunlight. Below this illuminated zone the plankton population rapidly thins out into the darkness and stillness of the abyss.

Although there is probably some life on the sea bottom at even the very greatest depths, yet the animals which compose the benthos mainly inhabit the sea shore or the shallow-water zone within the 100-fathom line, or the upper levels of the slope which descends into the abyss. This is partly because of the need for a suitable substratum over which to crawl or onto which to cling or into which to burrow. For these modes of life the soft oozes of the abyss are mainly unsuitable. But it is also because of the need for well-stirred-up oxygenated water, for the abundant food provided by the plankton, both alive and dead, close inshore and, in the case of fixed creatures, for constant movement to waft their food towards them. The enormous variety of conditions which is found between the tide-marks has led to an amazing diversity in the population of the sea shore

with which we are familiar. Animals have learnt to withstand, or have adopted protective devices for withstanding, such contingencies as being dried up for long periods, pounded by waves, smothered by sand, wrenched from their footholds or asphyxiated by lack of oxygen. Yet the number of different contingencies which may arise between the tide-marks is not infinite. The inhabitants, therefore, of a muddy shore, to take a simple example, in the tropics do not differ markedly in character from those of a similar shore in Europe or Australia. In the shallow-water zone below the low tide-mark conditions become progressively less diverse and more uniform, but at the same time, by reason of the darkness, the soft substratum and the stillness, less and less favourable for things that creep or burrow or merely cling.

The nekton, the class of swimming creatures, includes primarily the fishes and the whales. Since they can swim powerfully of their own volition from one place to another, it might be supposed that they would have a universal and world-wide distribution. But in fact most fishes are limited though widespread in their distribution. Some make greater or lesser migrations, such as the tunny and the cod. Whales also make migrations over vast distances. But the migrations of whales and fishes usually take place between well-defined areas. We believe, for instance, that while the Finner whales of the Arctic and the Antarctic appear to be identical and migrate towards the Equator at the breeding season, yet apparently they never cross it and never mingle.

The limits to the distribution of fishes and whales, and indeed all nektonic animals, are set mainly by the presence or absence of food.

The larger part of the nekton, the actively mobile swimmers, is composed of whales and fishes. (Below) *Pilot whales in the South Atlantic Ocean.* (Opposite) Saupes, *a species of sea-bream*

nders

From L'Aventure Sous-Marine *by Philippe Diolé (Albin Michel), published in England as* The Undersea Adventure *(Sidgwick & Jacks*

The bottom-living, or demersal, fishes, therefore, are limited by the factors which govern the distribution of the benthic creatures on which they feed. In the North Sea the plaice inhabit the Dogger Bank because the small molluscs on which they feed live there. The codfish frequents a stony bottom because there it finds the worms, molluscs and crustacea on which it feeds in the earlier period of its life. Later it is less restricted because it becomes more catholic in its feeding habits. The surface-living fishes, known as pelagic fishes, the herring, mackerel and tunny for example, are plankton feeders, or they prey upon other smaller fishes which are themselves plankton feeders. For them, therefore, the limiting conditions are largely those which govern the distribution of the plankton.

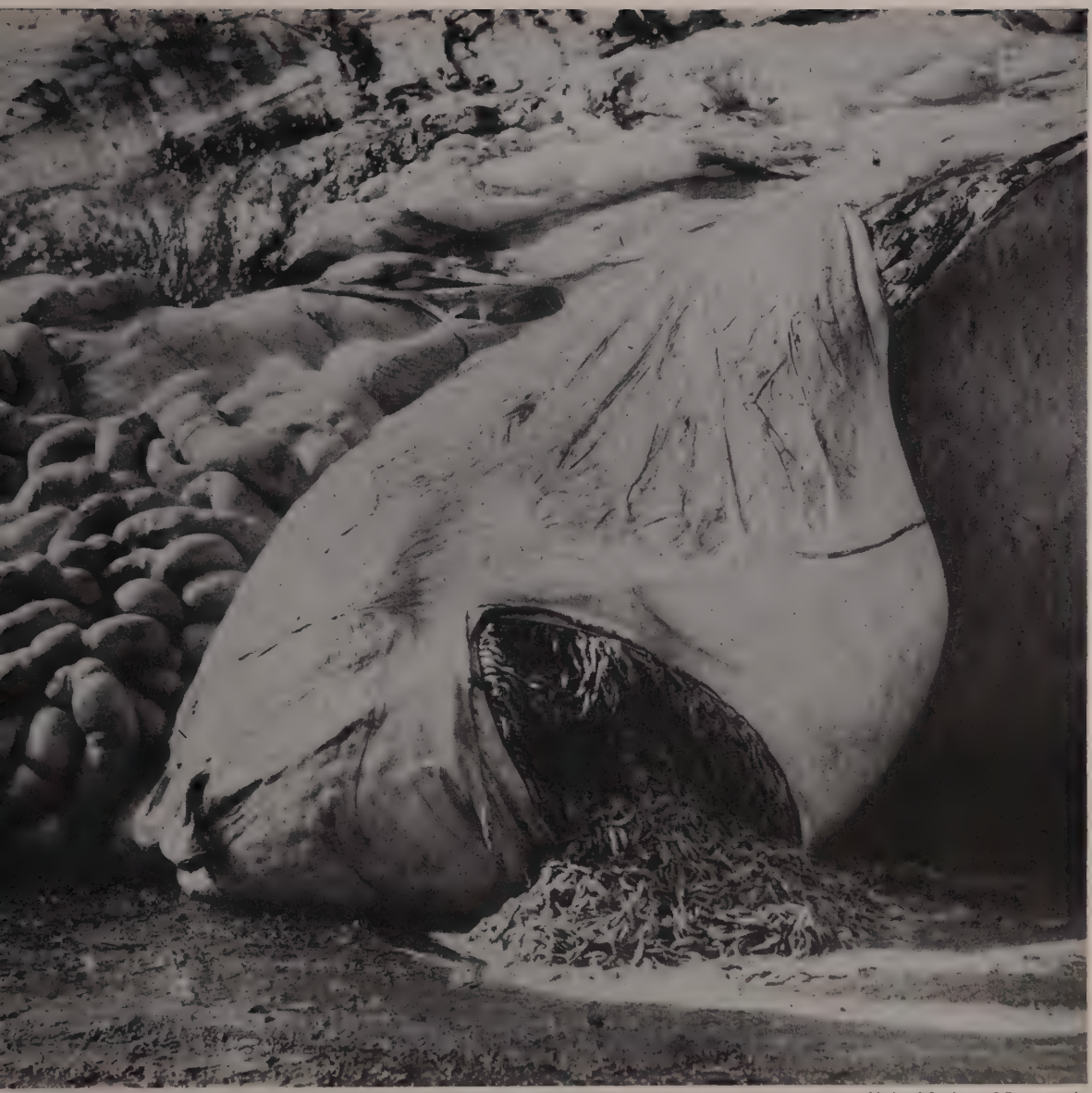
For the above reasons it follows that the fishes, and the great fisheries in general, are to be found in shallow water, usually on the continental shelf within the 100-fathom line or on the slope where it steepens into the abyss. For it is there that the plankton and the benthos, especially the latter, are richest.

The plankton inhabits the open ocean, drifting helplessly with the currents and the tides, and its environment is therefore uniform within wide limits. The principal limiting condition for planktonic life in the open ocean is usually temperature and every species has an optimum range of temperature within which it breeds and flourishes. Salinity, oxygen content and the chemical constitution of the water are also limiting factors, but they are of secondary importance. This floating population is tolerant of changes and may often be conveyed a long way by currents before reaching conditions which are unfavourable and where life is impossible. Nevertheless water of a particular origin, with characteristic chemical and physical properties, usually has its own particular and characteristic plankton population, distinguishable by the expert eye from that of water of another origin, having a different set of chemical and physical properties. The currents which carry bodies of water from one area to another thus sweep the plankton population peculiar to one type of water into areas where there is a population characteristic of another type of water.

An example of this is found at the entrance

Douglas P. Wilson

Douglas P. Wilson



National Institute of Oceanography

The plant and animal plankton (drifting life) is the basis of all marine existence. (Opposite, top) *A sample of diatoms (microscopic planktonic plants) magnified 115 times. These are chain-forming diatoms and each cell is an individual plant, a capsule of silica containing the green chlorophyll present in the leaves of terrestrial plants. Diatoms are the food of* (opposite, bottom) *the animal plankton. This sample, magnified six times, consists mostly of the larvae of crabs and other crustaceans and of molluscs. A copepod (oar-footed) crustacean may be seen in the top right-hand corner. The sole diet of the great whalebone whales in Antarctic waters is a form of plankton known as "krill", a small shrimp-like crustacean about two inches long.* (Above) *Krill pouring from the stomach of a whale cut open at a whaling station*

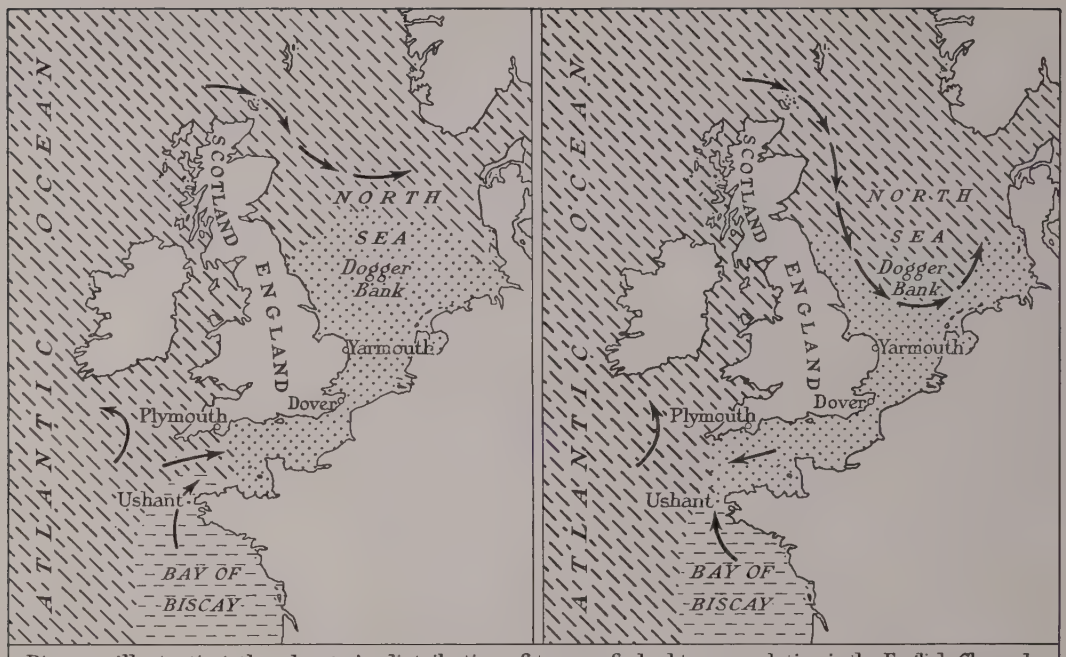


Diagram illustrating the change in distribution of types of plankton population in the English Channel when the flow of Atlantic water round the north of Scotland is strong

Atlantic water (Sagitta elegans) Channel water (Sagitta setosa) Biscay water

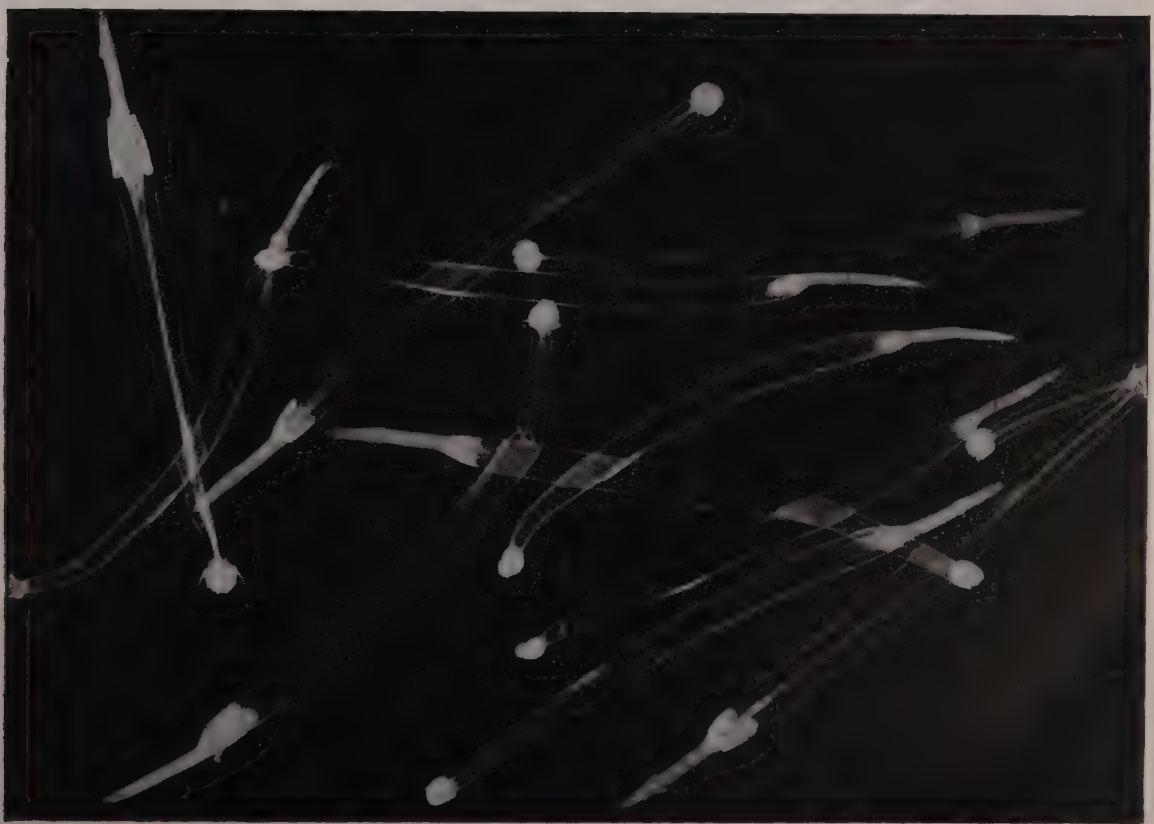
A. J. Thornton

to the English Channel where three types of water may be distinguished, having different origins and different physical and chemical properties. Each has its own plankton population, so peculiar and distinctive that even an untrained eye can perceive the difference. There is, first, water from the Atlantic Ocean, warm, highly saline, rich in phosphate salts. It has an abundant plankton population containing great numbers of a certain "arrow worm", *Sagitta elegans*. Secondly, there is water characteristic of the English Channel itself and of the North Sea. It is cold, poorly saline and poor in phosphate salts. It supports a sparse plankton population containing a smaller arrow worm, *Sagitta setosa*. Thirdly, there is a tongue of water from the Bay of Biscay which sometimes creeps round Ushant into the Channel. It is warmer and more saline than Atlantic water and supports a population of intermediate richness from which both the above-mentioned arrow worms are absent. Instead there are large numbers of the minute luminous protozoan, *Noctiluca*, and a small crustacean, *Euchaeta hebes*. It is this water which brings the occasional pilchard harvests to the coast of Cornwall. Each of these populations is so characteristic of the type of water it inhabits that biologists at the Marine Biological Station at Plymouth can tell at once from the catches in their plankton nets what type of water they are fishing in.

In the North Sea warm Atlantic and cold Channel water meet and mingle. Channel water flows in through the Straits of Dover and Atlantic water round the north coast of Scotland. In some years the North Sea receives more Atlantic water round the north of Scotland than Channel water through the Straits of Dover. In other years the flow is in the opposite direction. When the flow of Atlantic water round the north of Scotland is strong the mouth of the Channel is filled by Channel water. This is indicated by the appearance in the biologists' nets at Plymouth of *Sagitta setosa*. When the flow of Atlantic water round the north of Scotland is weak the mouth of the Channel is filled with warm Atlantic water and the biological nets take the larger arrow worm, *Sagitta elegans*. In the years of strong flow of Atlantic water into the North Sea a certain unicellular green plant, a diatom (*Rhizosolenia styliformis*), proliferates in dense swarms over the Dogger Bank. When this diatom is present the herring, for some reason not understood, avoid the Dogger Bank and the catches at Yarmouth and Lowestoft are poor. In the spring, therefore, the biologists at Plymouth can foretell, from the presence or absence of *Sagitta setosa* in their nets, whether the herring season later in

J. H. Fraser

(Above) Sagitta elegans, *characteristic of water from the Atlantic: here magnified five times.*
(Below) Sagitta setosa, *characteristic of water of the English Channel: magnified seven times*



Douglas P. Wilson and Journal of Marine Biological Association

Actual catches of ten-minute hauls with a conical net of coarse canvas, its circular mouth one metre in diameter, taken in water of three distinct types at the entrance to the English Channel. (Top) *A catch taken in Atlantic Ocean water, containing a rich plankton and* Sagitta elegans. (Bottom, left) *Channel water: a catch containing meagre plankton.* (Bottom, right) *Biscay water*

the year will be good or bad at East Anglian ports.

Since the environment of the plankton is so wide and uniform, the appearance of the population is remarkably similar all over the globe. It would require an expert to distinguish a sample of plankton taken from the North Atlantic from one taken from the South Atlantic. In general the plankton is far denser in temperate waters. In colder waters it consists of an enormous number of individuals belonging to comparatively few species. In tropical waters, on the other hand, we find a very large number of different species but only a few individuals of each. Again, close inshore the plankton presents a greater variety of species than farther out in the open ocean, from which we judge that the plankton population spread outwards from the shores of tropical seas to the tropical oceans and thence to colder seas north and south.

On a hypothetical globe, covered by a universal ocean without any land masses, it might be supposed that the watery envelope would represent a world-wide environment in which the limits to the distribution of species would be far apart and would be drawn by the physical and chemical conditions in the ocean itself. The most powerful limiting factor would be temperature and the population would for that reason tend to be arranged in latitudinal zones. In the southern hemisphere of our modern globe the distribution of animals tends to show a distribution along the lines of latitude. But the introduction of land masses upsets this arrangement in the north for it induces currents which carry the population out of one area into another. If only a single land mass had been introduced into our universal ocean it might be imagined that in the shallow water and littoral zones the population, whether benthic, nektonic or planktonic, would still show some latitudinal arrangement, corresponding with temperature, but there would be complications due to the introduction of a great but not infinite number of different environments. To a large extent this latitudinal arrangement can be seen on our globe today, for the difference between, say, the fishes of the coast of Kenya and those of the Cape coast are far greater than those between the fishes of Kenya and the Indonesian Islands.

But the splitting up of the world-wide ocean into separate parts divided by land masses seems to be leading to the development of separate centres of evolution in each ocean. To some extent each ocean possesses its own characteristic fauna. For instance, the common ocean bonito, a swift blue-and-silver fish sometimes called the "little tunny", is different in the Atlantic and Indian Oceans. Yet the two species differ only in the number and position of a few dark spots on the silver sides. Among plankton animals a similar but less marked differentiation can be seen and the character of the plankton population changes slowly but distinctly as we voyage round the southern hemisphere from the South Atlantic to the South Indian and to the South Pacific Ocean.

Mankind and all living things owe their existence to the oceans and to the majestic movements of water within them. Life began in the sea in warm shallow water lit by the sun and rich in nutrient salts dissolved from the soil and from the rocks. The lowly microscopic beginnings of life were carried by ocean currents into a diversity of conditions, some advantageous, some adverse, and so began the slow upward journey to mankind. When life came ashore and left the sea behind, it never lost its dependence on the ocean which makes it possible for the land to support life. The ocean is the great source of the water vapour in the atmosphere. It provides the rain that waters the earth and the clouds that give shelter from the rays of the sun. It is the stabilizing mechanism that ensures that life shall neither be burned up nor frozen solid. As for man himself, the ocean currents and the periodic monsoons have governed the direction and growth of his commerce since his history began and influenced the rise and fall of empires.

Autumn in Salzburg

by MICHAEL SWAN

Mist has covered the Untersberg for three days and by this only and the yellowing edges of the leaves the early autumn has become apparent, for there is no morning chill in the air and the sun can still burn hot. The artificial lake where I bathed throughout the summer has been drained and men are gathering the strange sub-aqueous vegetation as a winter food for the cattle, which in a week will have returned from their summer in the mountains and will graze for a while in the dried bed of the lake, nibbling the stalks of the vegetation that remains. Beyond the lake, towards Salzburg, are the humps of fir-covered hills that rise suddenly out of the plain and protect the town along its southern side; when I first saw them they strongly suggested —and they still do—a mediaeval landscape painting of the South-German school, or the landscape of a Grimm fairy-tale. Their Gothic atmosphere is completed by the Festung, the Fortress of Salzburg, which crowns the highest hump. It is deceiving, this landscape, because it is so contrary to the whole nature of the town; it cries for a town of richly ornamental Gothic churches and for the proud gables of burgher houses, and instead it encloses a southern town of Baroque churches, an Italianate cathedral and an Archbishop's Residence, all of which dominate the town architecturally and stand as symbols of the society of ecclesiastical courtiers that built them. The houses were never those of burghers; rather they were the terraced, unindividual homes of townsfolk who depended for their living on the Archbishop and his court. For the greatest creator of Salzburg was one of its Archbishops, Wolf Dietrich von Raitenau, who became its prince and permitted no burgher class to challenge his power.

To walk in the town, as I did today, after an absence of some weeks, was to rediscover it in a new way. The tourists photographing each other before Archbishop Guidobald Thun's lovely fountain were gone, the caravan post-offices erected for the festival month had been put away for the year, and once more the town was quiet, ready to eke out its August profits through the year, its people for the most part living unprosperously against this ironical backcloth of Baroque grandeur. In the square before Solario's fine façade to the cathedral the stage and seats for *Jedermann* have gone, and one now enjoys completely the proportions of the square, overlooked by the windows of the Residence and the Seminary. I remembered the strange, distant cries which had echoed from wall to wall—you could never tell from where they came—the cries of "*Je-e-e-derma-a-a-nn!*" as Hofmannsthal's rich burgher received the punishment of his conscience, and the beautiful moment when "Faith" stood in her blue silk vestments which, moved by the breeze, reflected the complicated folds of one of the vast statues forming part of the cathedral façade.

I walked on to the market place, where barrows of aubergines and autumn fruits crowded round the porphyry-coloured façade of the Kollegienkirche. It is my favourite church in Salzburg, the masterpiece, I think, of the elder Fischer von Erlach, a building that seems to move and change its proportions like some subtle architectural kaleidoscope as you walk around it—no mere façade, like the cathedral or many of the more naïve forms of Baroque building. Its front, a curving design which forms a central structure and two side towers, is a marvel of grouping, all surmounted by a miniature Cloud of Witnesses on the towers. Immediately opposite this church is the house where Mozart was born and where he lived for the first years of his life; from its kitchen he could have seen the top of one of these towers, the ecstatic statues of the Saints silhouetted, perhaps, against an intense blue sky, as it was the day I saw them from the kitchen window. So much in Mozart's music is explained when one realizes that the visual surroundings of his early years were those of a southern town, an Italian town, and that when he wrote the *Magic Flute* in the little house, the *Zauberflötehäuschen*, on the Kapuzinerberg, he looked down on a town untouched by the imagination of the north. And when I heard his symphonies and serenades played in the gardens of the rococo Mirabell Palace his style seemed to be an inevitable flow from this architectural ambience.

The festival last season, as always, was built around his music, with *Idomeneo* and *Magic Flute* being performed at the Felsenreitschule. The programme translated this word as "Rocky Riding School", and one could want

Paul Popp

Dominating distant views of Salzburg, the mediaeval Fortress on its crag and the surrounding fir-covered hills strike a northern, Gothic note. But this landscape is "contrary to the whole nature of the town", which is Baroque, urbane, southern and Italian in feeling

As you look down over the terraces of the cafés into the squares and across the river the true character of Salzburg becomes apparent: the array of churches, the Seminary and, above all, the Archbishop's Residence betoken this and are evidence of its long history as the seat of a series of high-handed prince-archbishops

Journal

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The tops of the towers and domes of the Baroque cathedral and the nearer Peterskirche appear surprisingly over the hedges of a garden on the Fortress hill, "giving the illusion of a vast Chinese pavilion which defies all the laws of perspective"

n Leigh

The Residenzplatz, flanked by the cathedral and the Archbishop's Residence, which were both rebuilt in the 17th century. Much of Salzburg's festival life takes place in the open air: operas are performed before the Renaissance façade of the cathedral—

Ernst Haa

—and in the Riding School, whose tiers of arcaded galleries were chiselled out of a quarry in the face of the hill for Archbishop Guidobald Thun in 1660. It was made into a theatre with a permanent architectural stage setting during the 1930s

The embellishment of Salzburg and its surroundings with fountains was indulged in by several archbishops. Leopold Anton Firmian caused a Baroque one (below) *with prancing horses to be built in Sigmundsplatz, a charming small square against the hillside in the heart of the town, while Guidobald Thun built that in the Residenzplatz and Marcus Sitticus Hohenems adorned the gardens* (opposite) *of his hunting lodge, Hellbrunn, outside the town with a series of them—playfully designed to dismay his friends. Hellbrunn itself, untouched since it was finished in 1618, is a monument to the cultivated taste of its builder*

ian State Tourist Dept.

Hagen

Salzburg in the winter, when "by the particular beauty of its inappropriateness the town becomes transformed by a covering of white", a contradiction which echoes and increases the surprise of finding a Classical town set in a Gothic landscape

no better translation than that. It is an ancient riding school with a series of arcades which have been cut out of the rock-face that overhangs half the length of the old town. Against this rock-face a permanent architectural set was built, in 1948, to designs by the Austrian theatre designer, Caspar Neher. He has been inspired by Palladio's Teatro Olimpico at Vicenza—and, alas, the comparison does not go in Neher's favour. The result is a huge non-proscenium stage which is perfect for the rather inhuman production theories of the leading Austrian producer of opera, Dr Oskar Fritz Schuh, but which, for myself, I found was too sprawling and unconfined for Mozart's operas.

Now I crossed the bridge and went into a café; a café where the festival critics would meet each day before lunch to discuss the previous night's performances and drink large *Seidels* of beer. Now there were four people there, less than there would have been on a normal day, for the too-frequent rain of Salzburg had begun again, the *Schnurlregen*, or ribbon-rain—so fine that one can hardly feel it. I drank coffee and read a book I had just bought about Archbishop Wolf Dietrich, a man who must fascinate anyone who visits Salzburg.

He reigned, for reigned is the word, from 1587 to 1612, and signed himself "*Archiepiscopus et Princeps*". His mind was bizarre and secular, and his private life remarkable for its passionate attachments. He created Salzburg architecturally as an image of his own nature by importing an Italian architect, Solario, who was one of the first men to bring the late Renaissance style north of the Alps. It was not until the end of the century that an Austrian could produce a national Baroque style—when Archbishop Johann Ernst Graf von Thun brought Fischer von Erlach to Salzburg. After Wolf Dietrich came a man with an imagination as bizarre as that of his predecessor, Marcus Sitticus Hohenems, whose most appropriate memorial may be found some miles from the town in the gardens of his hunting lodge at Hellbrunn. There is an old saying which the Salzburgers are fond of quoting at one, "*Wer Hellbrunn nicht sah, hat Salzburg nicht gesehen*"—"He who has not seen Hellbrunn hasn't seen Salzburg"—and it is true that Hellbrunn is a kind of explosion of a fancy which was kept under control in the town itself. Waterpower in the neighbourhood of Salzburg was ample and, perhaps to satisfy a neurotic impulse known to psychologists as "Undinism", Marcus Sitticus commissioned Solario to design various architectural surprises in the gardens, from which water might suddenly spurt at the unwary spectator. His open-air dining room contains a table and twelve stone seats, and during dinner his fellow-huntsmen would suddenly feel a stream of water enveloping the seats of their breeches, while jets would be directed at them from beneath the table. Or, while they were enjoying the beautiful grotto, full of bird-song and moving birds and animals controlled by water, a flood would descend from the mouth of a grotesque *putto* on the ceiling. No part of the garden was, or indeed is today, safe from the remarkable humour of Archbishop Sitticus.

The rain ceased and I walked back across the bridge, along the narrow alleys which may suddenly open, beneath an archway, into a vast beer-garden where the people of Salzburg hide together while the tourists drink at Tomaselli's and the Café Winkler or listen to zither music at the Zipferbierhaus. I have been only once to the famous Café Winkler whose terraces crown part of the rock-face and survey the town. It is a marvellous view at night, as the nearby searchlight picks out, one by one, the various beauties of the town, the small perfection of Erlach's Dreifaltigkeitskirche, the beautiful tower of the Peterskirche with its green copper onion-shaped dome. There is a view of this tower that gives me an unfailing stab of pleasure each time I see it, and I have seen it a hundred times as I've walked into the town over the Festung hill from the house where I am staying. You look across a garden which slopes sharply down towards the precipitous rock-face, leaving a clear horizon against the sky, above which appears part of the tower and the dome of the Peterskirche, giving the illusion of a vast Chinese pavilion planted in the garden and defying all the laws of perspective.

In a few months snow will be resting on all the domes of Salzburg and the jets from Archbishop Guidobald's fountain will be motionless, frozen at their source. It is then, I think, of all the seasons of the year that I should most prefer to be in Salzburg, to see this beautiful contradiction of snow and Baroque, twin to the other contradiction of a Gothic landscape surrounding so classically-minded a town. But Austria, poised between north and south, gives most of its pleasures in the form of contradictions—though it is a country that seems to have become tired with the effort of composing them all.

Prospects for Iraq

by
BRIGADIER
STEPHEN
H. LONGRIGG

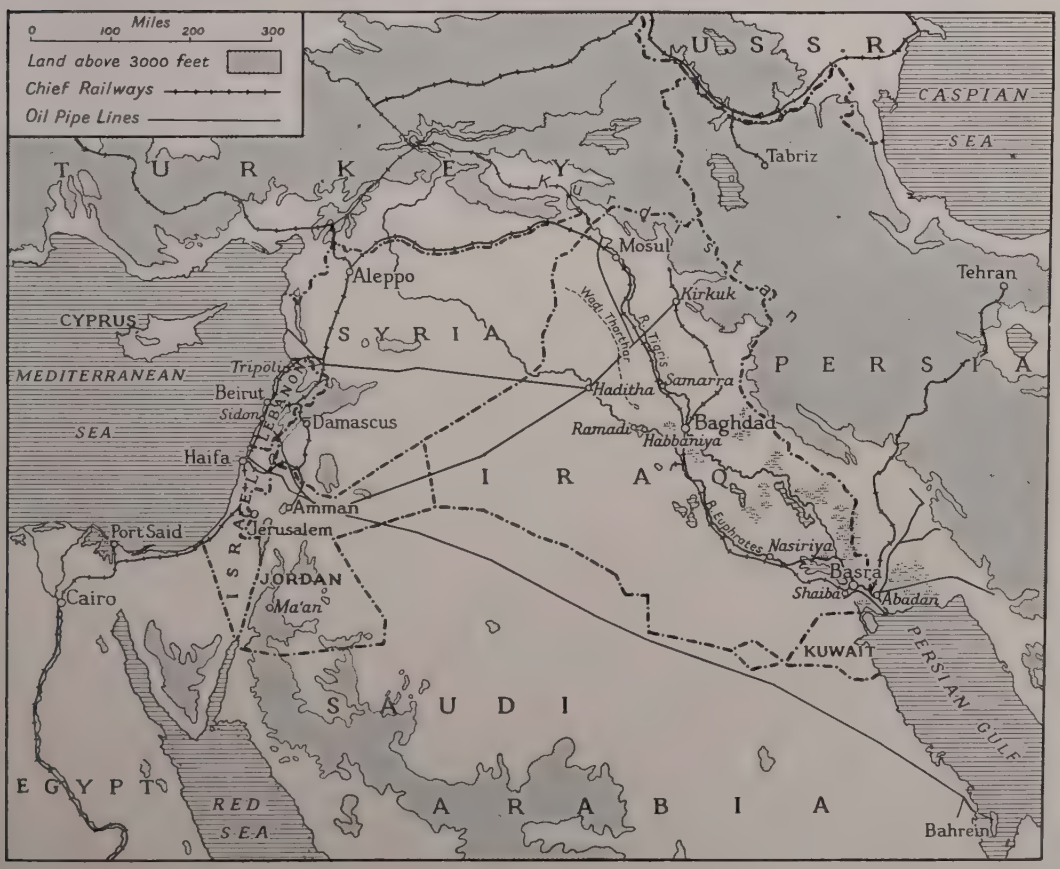
The Anglo-Iraqi Treaty of 1930, effective for twenty-five years from 1932, must be reconsidered soon. What will be the local background of future relations between Iraq and Britain? Brigadier Longrigg's answer is given in the light of many years' experience of Iraq as military officer, civil servant and oil-company executive. He is the author of Four Centuries of Modern Iraq *and his book* Iraq, 1900 to 1950 *is to be published by the Oxford University Press in November 1953*

When I first went to Iraq as a very young regimental officer early in 1916, the country had thousands of years of history behind it, and a great place in ancient and Biblical and mediaeval history—but an extremely shabby and unhappy present! British forces were engaged in driving the Turks out of a territory which they had neglected or misgoverned for four centuries; and the British newcomers were more conscious of the dirt and backwardness and poverty which they saw around them than of any glorious potentialities that Iraq (at that time generally known as Mesopotamia) might possess. Of course, everything looked its very worst; the 'best people' of Iraqi society had mostly retired from the scene with the Turkish forces; civil life, such as it was, was wholly disorganized; and intelligent contact with local affairs was, for most of us, hard or impossible to establish. But it was obvious that in spite of some modernizing tendencies in the 19th-century Ottoman Empire, and the recent efforts of the Young Turks since 1908, Iraq had not yet gone very far towards throwing off its long centuries of inertia and provincial backwardness. It consisted of three provinces—almost the most remote and neglected—of Turkey-in-Asia, with a foreign administration, foreign garrisons and a foreign language in use in the government and the schools. There was as yet scarcely the beginning of Arab pride or self-consciousness or nationalism, and the country at large had scarcely begun to awaken to modern ideas of physical development or mental enlightenment; and meanwhile the administration was starved, dishonest, inefficient and unpopular.

The countryside—and very often the towns—was insecure, the tribes dominant and traditionally "agin the government", travel unsafe, order and justice simply inoperative over wide areas. The means of communication were slow and primitive; they consisted of barely passable tracks, makeshift bridges (if any at all), inefficient telegraph services, a postal service—of a sort—only in big towns, very little wheeled transport, one short piece of railway line and the Port of Basra—then as now Iraq's only outlet to the sea—ill-managed and wholly

unmodernized. Although the country, except in the pure desert of the scanty, hungry, predatory camel-breeding nomads—a mere 5 per cent of the population—was overwhelmingly agricultural, nothing had been done for agriculture. Methods were primitive, crop-types poor and unsuitable, pests and locusts disastrously prevalent, yields wretchedly low, land tenure chaotic and highly discouraging to the grower, and poverty universal except in a very small class of absentee landowners. Irrigation, once (until the Mongols came in the 13th century) the boast and wealth of the country, had drifted into outworn feebleness with mere silted flood-channels, salinated lands and uncontrolled annual floods ruining the countryside and often inundating the cities. Social services—schools and clinics—were confined to the bigger towns, and even there were scanty and of the lowest standard. Even the cities of Baghdad, Basra, Mosul and Kirkuk were huddles of narrow smelly streets—the mediaeval "unchanging East" at its least attractive. There was no important industry, and no mineral resources were exploited.

Such fashions of life and government—the pre-1914 fashions—were all unworthy of a territory which had been great and possessed all the essentials which could make it great again. What were these essentials? Plenty of room? The area of the country is nearly 170,000 square miles and the population only about 5,000,000. Cultivable land? Iraq has at least 30,000,000 acres of this. The means of irrigation? Iraq has an adequate rainfall for crop-growing in its northern third, and its two great rivers to irrigate the central and lower thirds. A healthy climate? Iraq has this in spite of great summer heat. An intelligent population? Iraqis are exceptionally quick-witted, responsive, humorous and sympathetic. In spite of many local differences which included the essential split between town and tribe, and the main doctrinal (and partly social) distinction of Sunni and Shi'i, there was reasonable homogeneity throughout the Iraq plain; there was the raw material, in fact, for the building-up of a nation, even though manifestations of national spirit—or even of an Arab spirit as opposed to a Turkish—had been slight and local up to 1914. Only in the mountains of northern and north-



K. C. Jordan

Baghdad, with a rising population of 575,000, is still in large part the city of narrow streets and crowded bazaars that it has been since the Middle Ages, when the Mongol armies invaded and devastated Iraq. But its position as a centre of trade, from which its astute merchants have never failed to profit, has been greatly enhanced during the past thirty-five years by improved communications and by the economic development of Iraq. A new city is replacing and expanding from the old, whence 20th-century techniques and fresh ideas are spreading throughout the country

Cartier-Bresson

A. F. Kersting

Man learnt the arts of civilization under the tuition of great rivers; he took very early lessons on the banks of the Tigris and Euphrates. From Mosul (above) *to Basra* (left) *their waters are the life-blood of Iraq, named in both Greek and Arabic "the Land between the Rivers". Arab dhows have sailed from Basra to East Africa and to the Indies for three thousand years or more; but only in the last generation has it possessed facilities for handling modern large-scale traffic. In 1914 it had none; 462,000 tons of cargo passed through the port in 1920; more than 2,000,000 tons in 1950*

The ancient prosperity of Iraq depended on irrigation; and what Mongol hordes destroyed, good government can restore. Extensive engineering works undertaken since 1920 have brought thousands of acres under the plough; but the future lies with projects to divert the spring flood water into depressions at Lake Habbaniya from the Euphrates and the Wadi Tharthar from the Tigris; these works will raise the irrigated area from 7,500,000 to 17,000,000 acres. (Right) *The inlet channel joining the Euphrates with Lake Habbaniya.* (Below) *Earth-moving machinery assembled for the Wadi Tharthar scheme*

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Popper

In the high north-eastern mountains, in the plains and in marshes near the rivers there are many inhabitants of Iraq whose life is wholly or partly nomadic. (Above) *Kurdish tribesmen, whose language is akin to Persian and not related to Arabic.* (Below) *An Arab encampment in a riverside date-grove*

Popper

eastern Iraq—how welcome a contrast to Iraqi dead-flatness they seemed when one reached them late in the 1914–18 war, and first met their virile, hardy and truculent inhabitants!—the Kurds with their different language, traditions and orientation were likely to run ill in harness with Arabs, whom they despised.

The political history of post-1918 Iraq is easily told, though it has unfortunately been a good deal misrepresented by self-seeking or merely mistaken people of one kind or another. After the Armistice the British ran the country as Occupying Power for three years and then set up a Kingdom of Iraq under King Faisal, with a parliament, army, departments and everything else constitutional, modern and Western. The advisory functions (formerly executive) of the handful of British officials who were retained, and of whom I was one, grew ever less, and direct Iraqi control ever greater, until the final Anglo-Iraqi Treaty of 1930, and the admission of a free, independent Iraq to the League of Nations in 1932. Since then we have neither had nor asked any executive voice in Iraq's affairs: the Iraqis have retained or engaged some British advisers and experts as members of their Civil Service and under their orders; the British Ambassador has been to some extent—and no doubt more than other ambassadors—counted upon as an adviser, a wise and disinterested adviser, even by "anti-British" Prime Ministers; and by the terms of the 1930 Treaty we have maintained two Royal Air Force posts (with very few combatant elements) at Habbaniya and Shaiba. These posts were to have been handed over to Iraq under the Treaty of Portsmouth which was signed in 1948 but which the Iraqis—unwisely, as I think—rejected. They are the most direct but by no means the only target of a shower of abuse which has been ceaselessly aimed at us and our alleged "interference", "imperialism", etc., etc., since 1932 by scores of fervid journalists and by the Bright Young Men of Iraqi public life, who blame us for every defect in the condition of their country.

The truth is, however, that in twenty years Great Britain has intervened exactly *once*: to save Iraq in 1941 from a usurping and patently unconstitutional pro-Nazi military dictatorship—and a landslide to the losing side—in World War II. That the British Ambassador, or the British anything else, "interferes" in Iraqi affairs is today, for better or worse, simply not true; that the country is dominated from Shaiba and Habbaniya is not true, and could not be true, whatever stories the more irritated of the intelligentsia may spread around. And that the poverty and backwardness of most of the country is "all the fault of the British" is grotesquely nonsensical, however convenient we may be as scapegoats for the follies or selfishness or mere anachronisms of the past few hundred years of stagnation.

Of the great progress that Iraq has obviously made since 1918 in almost every sphere it is not possible to assign so much to the British, so much to the Iraqis themselves, except in the years 1919–1930 when almost all initiative and constructive work was British. For the rest, in spite of vitriolic politicians and military *coups d'état*, and apathetic or unruly tribesmen, and rowdy town-mobs and various other disturbing and delaying elements, there has been a great deal of genuine and sincere cooperation, goodwill and sound progressive work both in the later days of the Mandate and ever since: work accompanied, I may say in passing, by many very warm friendships between Englishmen and Iraqis who are (except when talking the cruder 'politics') a socially charming and very gifted people.

The period 1921–1951 was one in which aspirations to progress in the social services, the equipment of government and the means of communication were all starved by lack of funds. Iraq is a poor country, with little enough to tax even if one had (what nobody has ever yet devised) a perfect taxation system. It followed, therefore, that although a modern-type administration was established and many foundations laid essential to a modern state, and an all-too-political middle class came into existence, yet the development of irrigation was strictly limited—though studies and plans in plenty were prepared—the improvement and modernizing of agriculture could be scarcely touched, not very much could be done to leaven the great hard lump of general ignorance and illiteracy, or to improve the bad living conditions of the poor (which means nearly everybody) and their mediocre or inferior physical development.

Nevertheless, and in addition to the priceless contribution which these years made in creating a state and stabilizing society, one immensely important physical development belongs to them: that of the country's oil industry. This, entrusted by the Iraq government in 1925 to the great international group now known as the Iraq Petroleum Company, has grown from nothing to dimensions which today place Iraq very high among the world's

Forty years ago most of the bridges across Iraq's many waterways took the form of rickety pontoons such as that over the Euphrates at Nasiriya (below). *But these are now gradually being replaced by more solid constructions.* (Above) *The new road-and-railway bridge over the River Tigris at Baghdad*

G. H. Waumsley

oil-producing territories; and that Iraq itself —and not, as they love to assert, "the foreigner" only—will benefit from this great source of wealth is assured by the terms under which the Company operates. These conditions, first established in 1925, were periodically revised (always in Iraq's favour) and in 1952 a "fifty-fifty" basis was established whereby Iraq receives half the profits made by the Company—or rather the group of three triplet companies, of identical parentage and constitution—from its operations in Iraq, before deduction of taxes. The government's share so calculated reached £33,000,000 in 1952 and will reach £50,000,000 or £60,000,000 in future years, on the basis of exporting 30,000,000 tons a year of crude petroleum: and all this, of course, with no finger lifted or penny risked by the Iraqis themselves otherwise than as employees of the Company. And yet young politicians are found—I talked to a couple in Basra a few months ago—who would rather "nationalize" Iraqi oil (which of course is national property already) and bring the whole industry to a standstill—kill, in fact, the unique and truly wonderful golden-egg-laying goose, on the pattern so disastrously demonstrated by Dr Musaddiq next door—rather than allow the "foreign companies" to operate and prosper in their midst.

The future, in this matter, is not assured; one cannot rule out the possibility of some tragic act of folly or malice; if in Persia, why not in Iraq? But meanwhile a Development Board, a permanent non-political body, has been set up and has the spending of 70 per cent of the oil revenues; and it has already gone a long way with its studies, preparations and initial work. Given a fair chance, the Development Board can proceed henceforward with its well-laid plans for more and better schools, and thus slowly build up a literate, instructed electorate, produce its own experts in all subjects, and enable the country to contribute, as it scarcely does today, to the world's intellectual life. It can extend a comprehensive medical service, and improve the national physique, weakened today by too much bilharzia, hookworm and malaria. It can extend town-planning, clean up filthy back-streets, offer healthy living conditions, provide villages as well as towns with drinking water, light and suitable amenities. It can develop the road system and open up remote areas, helping thus to create a sense of national unity and shared interests. It can aid and foster such local industries as the general lack of raw materials, and the limited local market, may allow; and these in time may be considerable. It can vastly increase the extent of land under the plough. It can prevent the present annual flood-disasters by great irrigation projects, which are already formulated and well begun and are capable of very great extension on wise, progressive lines. It can drain the great marshes of southern Iraq. It can take the lead in afforestation, for which wide areas are suitable. It can specialize crop-types to meet semi-desert conditions, and overcome the locust and other pests. It can thus in agriculture and stockbreeding build up sources of national livelihood in readiness for the days when oil will be exhausted or—who knows?—superseded. It can make Iraq a great contributor to the world's food-supply: a self-supporting, self-sufficient and self-respecting nation able to take the lead in that part of Asia and in the Arab world.

Why not? What can be wrong with these expectations? Nothing, I hope; they may all come true. But if one's confidence is hesitant —and perhaps the better one knows Iraq, the more one hesitates—why should it be so? There are three reasons. One is the international situation; one is the Iraqi character; and one is the instability—essential, unavoidable word!—of its public life.

The international situation—not anywhere too bright today in the "Free World"—has, or could have, special dangers for Iraq. It is militarily a weak country; it stands at a highly strategic point in world communications by land and air, a point essential to hold, fatal to lose, if a global struggle takes place. It has very great oil resources, of which an enemy would dearly love to deprive the Western Powers, even though, because of pipeline considerations and because there is as yet no major refining industry in Iraq, that enemy could not use them himself. And it is only a short step from Soviet territory to northern Iraq, across mountains where the Kurds have already had more than a little Communist indoctrination, and are in general anti-Arab anyhow and, in the last resort, doubtfully loyal to the Iraq government. Meanwhile, though all Iraq Cabinets have been strongly anti-Communist as a domestic issue, the suggestion that the country should align itself definitely in the Free World's defensive system, by joining a Middle East Defence organization, for instance, has been ill received in Baghdad; it is politically unpopular because of Great Britain and America's support of Israel, and because Iraqi xenophobia is less discriminating between the "foreigners" than it might be, and because neutrality as

Iraq's modernization schemes will cost very large capital sums. Oil is providing these. British, Dutch, American and French interests combined in the Iraq Petroleum Company and its associated companies have raised Iraq's production of oil from 5,000,000 tons in 1946 to an estimated 25,600,000 tons this year; and the Iraq Government gets half the profits before deduction of taxes, receiving £33,000,000 in 1952

To bring the benefits of these schemes to Iraq's 5,000,000 people and ensure their continuance, a new class of administrators and technicians is needed. The Iraq Government and the Iraq Petroleum Company are each training men and providing them and their families with up-to-date houses and other amenities. (Above) *A modern residential suburb of Baghdad.* (Below) *Students outside Baghdad Engineering College*

ourtesy of Holloway Brothers (London) Ltd

In 1914 Iraq had seventy miles of railway line from Baghdad to Samarra. It now has over 1000 miles and developments planned will include a realignment to bring into use (above) *the newly-erected terminal station near* (below) *the present Baghdad West station, where the night mail is seen arriving from Mosul*

I. Waumsley

The successful accomplishment of Iraq's social revolution requires, more than anything, stability and disinterested leadership. For this, Iraq's well-wishers look to her eighteen-year-old monarch, who was crowned this year. (Above) *His Majesty King Faisal II with the Prince Regent*

between the West and Soviet Russia is a popular conception—even though, in the last analysis, a nonsensical one. It follows that one cannot be too confident that Iraq will, in years to come, be able to keep at bay all that Russian penetration and menaces, or actual assault, might mean. I do not feel that Iraqi statesmanship has taken yet a clear and objective view of the Russian danger; their line too often is: "This is a British or British-American bogy to scare us into attachments which would limit our independence and favour the West" (whom it is far more fashionable, if not politically indispensable, in Baghdad to abuse) "and put us 'in bad' with the U.S.S.R."

This attitude of uncertainty on so vital an issue is one reason for restraining confidence in Iraq's future. The next is the character of the average Iraqi—well as I know the risk of imputing 'national characters' to peoples (who are just millions of individuals), and small as is the class of Iraqis whose 'character' matters today one way or the other to the state. But it remains true that a prevailing majority of Iraqi (and, one might equally say, Arab) politicians and publicists do show certain strongly marked and consistent traits, quite different from those of, shall we say, the Swiss or Swedes or British. They are highly emotional, and emotionally self-persuasive. They do not, by any sustained intellectual processes, think out their politics : they tend to rush into them, commit themselves with enthusiasm, and then blame other people when it is difficult to get out again ! They are over-confident in their first impressions, yield to the impulse to adopt a ready expedient for an immediate objective (such as the discomfiture of a rival), and lightly create situations which then prove altogether too much for them : for instance, the organization of street demonstrations, or student strikes, or tribal uprisings (all of which are habitual political weapons, and all deadly dangerous) which a political faction can easily organize, and will then most uneasily regret. The spirit of compromise, the give and take, the "art of the possible" view of politics : these are all unknown to too many Iraqi politicians, and more particularly to the now uprising younger

leaders. These characteristics are regrettably constant: they are not ungenerous, indeed often attractive; but they are not easily consistent with the type of governmental regime which the same men claim to value, and they have led, over and over again, to folly and to disorder.

They are, indeed, part of what I will next mention: the chronic instability of Iraqi public life, which I fear to be a serious menace to its prosperous future. Fundamentally, this instability is nobody's fault; it arises from too rapid a transition, a transition due not to organic growth but to political decisions, from the static certainties of Turkish government and Islamic conservatism to the ruthless competitive international world of the 20th century. It seemed in 1920, and it seems today, improper to provide Iraq, as a new state, with a dictatorial, or an aristocratic, or a theocratic form of government—and if not, what is left? Only parliamentary democracy, I presume; and the politically articulate Iraqis demanded it, the spirit of the times approved it, a new modern-minded state could, it seemed, take no other form. But in fact this is the most difficult of all forms of government to operate successfully; it demands centuries of evolution behind it, a real country-wide recognition of certain values and obligations, an electorate at least partially instructed, a political class with some experience and capable of restraint, and political parties which really stand for principles or formulated programmes and have a sizable following among a public which believes in them. Now Iraq is simply not, or not yet, that sort of country. It is a country where four-fifths of the inhabitants are illiterate, almost primitive, villagers or tribesmen, totally incapable by their ignorance, their social system, their remoteness from the 20th century of taking, for years to come, any true part in a democracy; one-fifth are partially educated townsmen, who know a little of what a modern constitution and administration looks like; and one-hundredth, or less, form the political element. This tiny political class, with its sheaves of red-hot newspapers, struggles and vociferates in a world quite remote from the countryside. The Deputies, who are neither stupid nor malevolent, sit in Parliament because they are the heads of the bigger tribes, or because they are in effect nominated by the Minister of the Interior or Prime Minister of the moment for their election to be ensured, easily enough, by the provincial governors, or because they have, in a small minority of cases, succeeded in attracting a personal following in Baghdad or Basra or Mosul. The Chamber is, therefore, not a genuinely representative body, nor can it become so for many years; it does not wield real power, nor control Cabinets. The latter, themselves nominated by the Prime Minister, make all decisions, limited only by their own disunities which destroy them at the rate of two or three a year. And it is open meanwhile to politicians out of power to use, as I have said, every weapon of mob-raising or tribe-incitement to thwart or destroy the Cabinet of the day: open no less, as events proved repeatedly in the period 1936 to 1941, to the Army to intervene and pull down or put up a government—that is, a Cabinet—agreeable to itself.

With this lack of solidarity between the people and their representatives, between the latter and the Cabinet, between the Cabinet and the Army or the easily-excited tribes or city mob, it can be imagined how fragile is the structure of government. It is perhaps not too much to say that one scarcely knows from week to week in Baghdad what *coup* will happen, what demonstration lead to violence, what decision be reversed. And greatly as the British government and a great body of British friends of Iraq—many of whom, like myself, served that country for years, with all the goodwill and devotion at their command—may desire its stability and the correction of its faults of structure and temperament, there is little enough that they can do about it. It is a common situation in human affairs that, wanting desperately to help somebody, one can find no means of doing so; and so it is with Iraq and its foreign well-wishers. It is common, too, that the interested onlooker is blamed for what he in no way caused: so Great Britain will no doubt be blamed for whatever untoward may happen in Iraq, as it is blamed already for causing, or at least perpetuating, its present shortcomings.

But many Iraqis know all this. There are men of long experience, courage and goodwill in Baghdad; men who know their own country *au fond* and have ridden its storms before, and men whose enthusiasm may yet be proportioned by trial and error without, one hopes, losing too much of fire and benevolence. The monarchy is a steadying and respected element: a young Harrovian king of fair promise has just been seated on the throne which his uncle, the Regent, has kept for him with notable loyalty and competence for fourteen years. He, and men of goodwill around him, will help to realize in Iraq all that Great Britain could wish to see there—a stable and prosperous state, in a territory exceptionally blessed by Nature, and a population of unusually attractive human beings.